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New Four-head Planer.

The illustration of new four-head planer, built by The G. A. Gray Co., Cincinnati, Ohio, is intended to show proportions of parts subjected to special strains, while under the load for which the machine is intended.

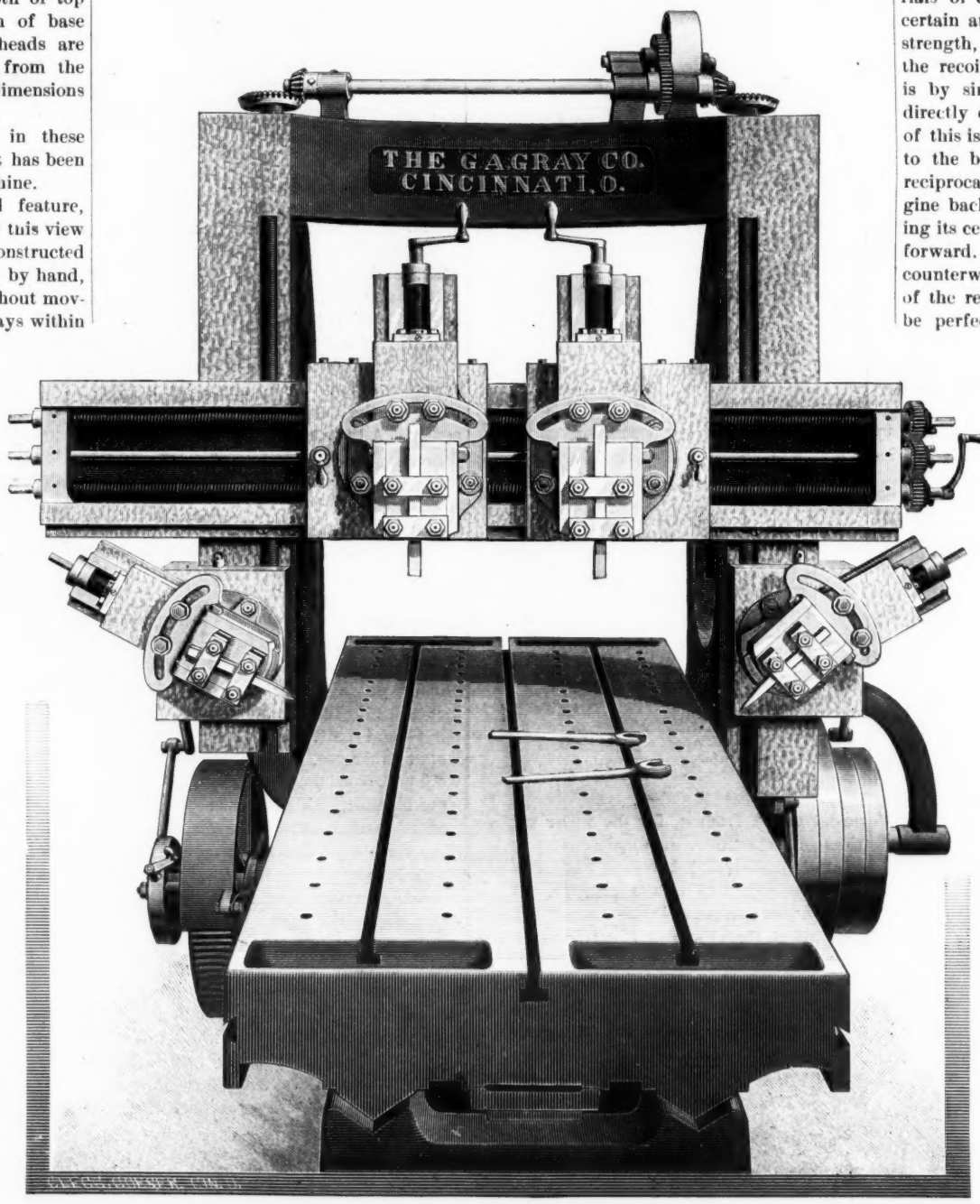
The rigidity depends largely upon the width of face of uprights, and depth of top brace, as well as upon the width of base of uprights, and when the side heads are in use at a considerable height from the platen it is found that these dimensions must be ample to prevent tremble.

The generous surfaces shown in these parts give evidence that this point has been cared for in the design of this machine.

The side heads have a special feature, which cannot be clearly shown by this view of the machine; they are so constructed that the operator may move them by hand, and throw the feeds in and out without moving from his position, and are always within easy reach while his eye is on the work, the cranks and feed devices being attached to and a part of these heads, and travel up and down with them.

These side heads have swivels, and are brought forward to a line with the heads on the cross slide; this provides for all four tools starting and leaving the cut at the same time.

Other features in planers made by this company are familiar, having been described in these columns before.



NEW FOUR-HEAD PLANER.

Force in the Steam Engine and its Relation to Smooth Running.

SIXTEENTH PAPER.

BY PROF. JOSEPH TORREY.

This seems to be the proper time for a brief study of the subject of counterbalance—perhaps the most vexed question in all steam engine construction. I have had some curiosity to see what had been previously said in the AMERICAN MACHINIST on the subject, and have been over all the back numbers from Vol. 1, No. 1, to date. I wish there were space to bring all the different articles and notes together. They would, as a collection, be exceedingly interesting to experienced engineers. There is hardly any subject on which such diversity of opinion prevails, or in respect to which there is such wide variation in practice.

I have no expectation of bringing to light anything new on the subject, but shall try to approach the subject in such a way as to make *principles* clear to young engineers. It cannot be too often emphasized that there is law and reason behind everything, and there is a reason for every variation from supposed law. The idea really seems to prevail, however, in some quarters, that engine balancing is something outside of mechanics altogether, and is a sort of secret known to various individuals through certain "practical experiments." A great deal of this apparent mystery comes from the fact that no two men seem to be talking about the same thing when the subject of counterbalance is up, and the ground is shifted about so from high-speed to low-speed, stationary practice to locomotive and marine practice, side crank to center crank, horizontal to vertical engines, that it is almost never that we get any extended and digestible information on any one of these subjects. There are, of course, several different types of engines and many wide variations in circumstances, but there does not seem to be any good reason why two engines of the same class, at the same speed, and under practically similar circumstances should not be counterbalanced alike. Of course the reason is that builders disagree as the amount of counterbalance needed; but *why?* There are certain results that are desirable. There are others that it is equally desirable to avoid. Is there not some general principle that will enable any one to proportion a satisfactory counterweight in any case, knowing the conditions? It is one of the cases where it certainly looks, as Mr. Williams says, as if science were the most reliabl guide.

We will then examine the subject in the same elementary manner as we have the other questions of steam engine force, and first we inquire why it is necessary to balance engines any way. The reason is simply this: The reciprocating parts resist being put in motion at the beginning of the stroke in exactly the same manner that a cannon ball does, and as the steam overcomes this resistance the engine recoils just as the cannon does with the force of the exploding powder. Evidently, then, the amount of recoil will depend on the amount of resistance to being set in motion, or inertia; and this will depend on two things: first, the weight of the reciprocating parts, and second, the speed with which they have to be put in motion. This recoil takes place, of course, at both ends of the stroke, but is a little greater at the back end, simply because inertia, as we have seen, is a little greater there than at the front end, on account of the faster piston speed. And the result, if no attempt were made to correct it, would be a violent and disastrous horizontal shaking of the whole engine (and foundation too, for that matter,) in case of every high-speed engine.

Now, how can this very objectionable force be met? It is useless to try and banish it as long as steel and iron are the standard materials of construction, for there must be a certain amount of metal to give the needed strength, and every pound of weight adds to the recoil of the engine. The way it is met is by simply introducing a counterweight directly opposite the crank-pin. The result of this is that just as the engine comes, say, to the back center, and the inertia of the reciprocating parts is acting to throw the engine backwards, the counterweight is exerting its centrifugal force to throw the engine forward. If the centrifugal force of the counterweight were just equal to the inertia of the reciprocating parts the engine would be perfectly balanced *horizontally*, that is, it would be free from horizontal swaying. Practically this cannot be done completely, and the reason is easy to see. The centrifugal force of the counterweight is constant at every part of its circular path, while the inertia of the reciprocating parts, which was 40 lbs. per square inch at the back end, would be 29.8 only at the front end, so if our counterweight gave 40 lbs. centrifugal force per square inch of piston area, the engine would be balanced at the back end, but at the front end the counterweight would exert 40 lbs. centrifugal force against only 29.8 lbs. inertia, and evidently the balancing would be overdone.

The closest approximation we can make to perfect balance in the horizontal direction is to underbalance a little at one end, and overbalance a little at the other end, and this is generally done by proportioning a counterweight so as to give a centrifugal force equal to the *average* of the inertia forces at the back and front ends. Thus in the case before us the required centrifugal force would be the average of 40 and 29.8, or 34.9 lbs.

By reference to the thirteenth paper, it will be seen that, in order to produce this force, we need a counterweight equal to the whole mass of the reciprocating parts. This will balance the reciprocating motion. There is one more element, however, and that is the crank and pin, which by their weight exert centrifugal force contrary to that of the counterweight, and with the reciprocating parts, so we need to add to our counterweight an amount equal to the weight of crank and pin, and our work is done as far as it can be. Care must be taken to so proportion the counterweight that its center of gravity and the center of the crank-pin shall be at equal distances from the center of the shaft. The best and most convenient manner of applying the counterweight is to use a disk crank (or

crank disk (?) and cast the counterweight on it. In case of a double crank disk the counterweight is equally divided between the two disks.

If the work has been done as indicated, the engine will be balanced horizontally, as near as may be. Mr. Porter pointed out, years ago, the curious behavior (very curious at that time no doubt) of an engine thus balanced, and so placed as to have free motion horizontally by rollers or otherwise. Under these circumstances the engine will slowly hitch itself backward, owing to the very slight underbalance at the back end and overbalance at the front end, both of which, as a little reflection will show, tend in the same direction; one acting when the crank is on the back center, and the other on the forward center. It is needless perhaps, to say that these slight disturbances of perfection are of no practical importance.

Another element would, however, begin to show itself at about this stage of proceedings, which would need most careful attention, and this would be the action of the counterweight at other points than on centers. At these two points, as we have seen, the centrifugal force of the counterweight is opposed by an approximately equal force, but at any other point not so. At half stroke, for example, the centrifugal force of counterweight is opposed by only the centrifugal force of the crank, crank-pin, and the large end of connecting rod, and the result is a force tending to lift the engine off its foundations. At the bottom quarter the same thing takes place, only the excess of force is downward, instead of upward.

This, I think, makes the statement with regard to counterbalance, pure and simple, complete.

In short, the counterweight can be proportioned so as to give either,

1. Perfect horizontal balance.
2. Perfect vertical balance.
3. An equal amount of balance horizontally and vertically.

The practical considerations which may determine its amount will be further considered.

There is a great deal of truth in the following, from the *Northwestern Lumberman*. If there is anything in the world that a man feels it incumbent upon him to do, it is to sign his name so that no fellow in the world can read it. There ought to be a stand made against the man, whatever his position, who signs his name so no one can read it.

The importance of giving the names of business men accurately and in full, is not sufficiently appreciated by every one. Business men themselves are at fault, and those who write matter for publication, and whose duty it should be to use extra care, are continually at fault. The initials of this or that member of a firm or company are so often needed and inquired for, that it seems as if every business concern having much correspondence, would readily see the necessity of placing on their office stationery the full name of each member of a concern. Correspondents to newspapers should especially bear in mind that business styles should be given accurately and without abbreviation, and that great care should be taken to have individual names correctly written. So also should the names of railroads be written out, for although many roads are well known locally by a contracted name or a set of initials, the public at large will not be able to make all the necessary interpretations, and every reader of a paper should be taken into consideration in preparing information. The *Lumberman* is often forced to throw out good news because of such failure to make details clear that the information is invalidated.

One of the latest theories advanced is, that the generation of so much artificial electricity as is now going on is changing the constitution of our atmosphere, and causing the heavy and numerous storms and epidemics which we are experiencing. It has been said that many worthy people can never be thoroughly happy unless they are miserable, and this new theory will probably give them something to worry about for a while. It evidently owes its origin to the erroneous supposition that all the electricity generated by our dynamos is thrown off into the atmosphere, or into the ground, in the form of electricity, which, of course, is absurd.

Air Pumps.

By W. H. Booth.

In Europe, air pumps are very frequently made of the horizontal type, that is to say, the bucket of the pump is upon a continuation of the steam cylinder piston rod, and the air pump bucket has a speed equal to that of the piston. The horizontal air pump is thought by some engineers to be less efficient than the ordinary type of vertical pump, and indeed has too frequently been so; but this is not because there is an invariable reason for such default, but because some one has blundered, and it may serve a good purpose to inquire into the points necessary to be observed in the design of a horizontal air pump, so as to insure noiseless and efficient action.

An English engineer of recognized ability recently stated that the bucket of an air pump should only travel at such speed that the water in the spaces at the ends of the pump casing should be able to follow the bucket under the action of gravity. This statement imagined a pump as in Fig. 1, with flat-ended bucket. In such a pump as this, the true action of the bucket is not, as it appears, horizontal so far as regards the

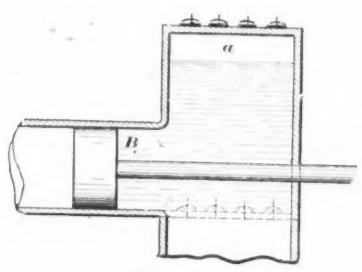


Fig. 1

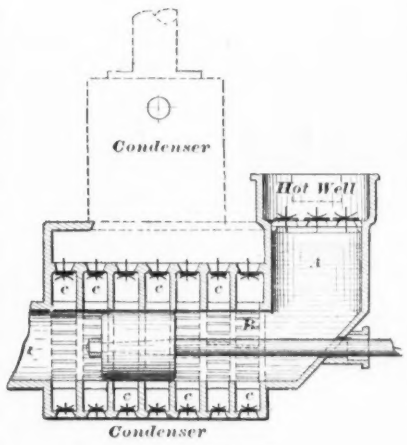


Fig. 3

outlet valves from a, for the water surface rises and falls under the displacement action of the bucket, and becomes itself the virtual working face of the plunger. If the area of the surface a is the same as that of the bucket, then the water surface will rise and fall through a distance at each stroke of the pump, equal to the bucket travel; but if the area in horizontal section of the chamber a is greater than that of the plunger, then the water surface will vary in height, through a proportionately less amount. If the bucket travel at a rate of 800 feet per minute, as it will do if attached to the piston rod of some high-speed engines, and if 200 feet per minute be considered as the maximum allowable speed of a pump bucket, then the chamber a must be in cross-section four times the bucket area.

Even when this is done, however, there still remains the chance that the water will not follow up the bucket, and that a hollow space will be left between the bucket face and the water following it up. As the bucket slows up towards the extremity of its stroke, the water which is following it up overtakes it with more or less of shock. In a pump running at a mean speed of 840 feet per minute, the maximum velocity will be about 1,320 feet, or 22 feet per second. If the stroke of the pump be 5 feet, the number of strokes per minute will be 168, or one stroke in $\frac{60}{168}$ of a second (357 second). Thus a half stroke of $2\frac{1}{2}$ feet is made in .178 of a second. Now in this period of time, under gravity, a falling body will attain a velocity ($32 \times t^2$) of $32 \times .178^2$, or only one foot per second, and will move through six inches. But the pump bucket has in the same time attained a speed of 22 feet per second, and traveled 30 inches under the motive force transmitted through the rod. There will thus be a gap of 24 inches between the water and the bucket. It must not, however, be forgotten that between the bucket and water there is a good "vacuum." The water temperature being 100 degrees, the pressure can only be that due to this temperature, or one pound per square inch. The pressure on the surface a is at the same time probably $2\frac{1}{2}$ pounds absolute, giving a difference of $1\frac{1}{2}$ pounds urging the water forward. This, added to the head of the surface a above the bucket center, is the net pressure driving the water horizontally after the bucket. The head of a is, say $1\frac{1}{2}$ feet, or $\frac{3}{4}$ pound, giving a total of $2\frac{1}{8}$ pounds per square inch, to move a quantity of water whose mean horizontal length is, say 18 inches. Now an inch square column of water, 18 inches long, weighs $\frac{3}{8}$ pound. Hence $2\frac{1}{8} \div \frac{3}{8} = 3\frac{1}{4}$, and this is the relative forward effect on the water as compared with gravity = 1. Now gravity

Fig. 2

would have moved the horizontal column through 6 inches, as we have just seen. This, multiplied by $3\frac{1}{4} = 19\frac{1}{2}$ inches. The actual gap of 24 inches is thus reduced to $30 - 19\frac{1}{2}$ or $10\frac{1}{2}$ inches, and, though the fault is seen to be reduced, it is by no means abolished, and it is seen that satisfactory action can only be attained by a greater head of the surface a above the bucket center. A little consideration will show us, however, that the design of a direct-action pump may be modified so as to avoid the risk of shock. The error of design in the pump of Fig. 1 type is the long barrel and short bucket, which compel the water to flow and reflow violently into and out of the barrel of the pump B.

This clearly is a source of loss, through eddies and friction. We have seen that, at the speed given, water will follow the bucket during its half stroke a distance of $19\frac{1}{2}$ inches; as the bucket slowed down during the second half, the velocity of the water would increase, and finally the bucket would be overtaken, and more or less shock would result, which would be intensified under worse conditions, which would give time for the bucket to commence its return stroke before meeting the water.

During the latter portion of the flow of the water along the pump barrel, there would not be that acceleration of velocity usually due to gravity, because that proportion of all the moving water whose direction of flow was horizontal, would be simply inert, and resist any acceleration; and, moreover, the length of horizontal water continually increases, whilst the vertically moving water becomes less in height and energy, and, though it would be difficult to say exactly what would take place, it is easy to see that between the bucket face and the moving water the gap may be very great, and the bucket may simply travel to and fro between two faces of water, one or other of which is always out of contact. The output of such a pump cannot be anything near its maximum.

Seeing, however, in the case in point, that, during the period of half stroke there is time for water to fall nearly 20 inches under the combined action of gravity and superincumbent pressure, we may take it that the vertically moving water (Fig. 1), whose surface is a, and whose height is 18 inches above the bucket rod, would fall 20 inches during the period of half stroke. A knowledge of this fact affords a clue to correct design.

Suppose in Fig. 2 there be attached to the face of a bucket a convoidal elongation K, tapering from the full diameter of the bucket to that of the rod. Then, if K be equal in length to the half stroke, the bucket may be of such diameter that the rise of water upward, added to the known rate of its downward fall, shall not exceed such diameter. The upward rise, of course, is dependent upon the inflow at the lower valves from the condenser, and the flow of water round the plunger under the pressure in the surface a. Suppose, for argument, that the up and down movement are equal. In that case the difference in radius of the two ends of K might be 20 inches, and the bucket could be made 40 inches diameter plus the diameter of the rod. If a bucket of 20 inches only beyond the rod were employed, it would be possible to reduce the length of K below thirty inches, because, while the plunger moves the length 30 inches, the water will move in to the center a radial distance $x\ y = 20$ inches.

When $x\ y$ is reduced to 10 inches, the period of flow will be as before

$$t = \frac{d}{16} \div 3\tfrac{1}{4},$$

d being the distance moved in feet, or $\frac{1}{16}$ of a foot, and the number $3\frac{1}{4}$ being the excess of pressure over mere gravity alone, which forces the water to fill the vacuum formed by the retreating plunger.

Working out gives $t = .07$ of a second.

Now, when the half stroke of 30 inches is performed in .178 of a second, we found $K = 30$ inches, for $d = 20$ inches. The length K for $d = 10$ inches may now be $\frac{.07}{.178}$ of 30 inches, or barely 12 inches. With such a projection of K, only 12 inches from the face of a 20-inch bucket, there would, under the assumed conditions, be no shock, and even if the water did not close in upon the plunger as quickly as this moved away, the peculiar form of the projection would obviate all shock. Such a construction of pump has been very usefully employed, but is perhaps scarcely suitable to long stroke air pumps, because of its cumbrousness and length.

For a 40-inch cylinder a double-acting air pump need not be over 14 inches diameter. The flow of water in such a pump would be only $d =$ say 6 inches, and $t = .05$ second only, so that K becomes $30 \times \frac{.05}{.178}$, or only about 8 inches on a 14-inch bucket.

We begin now to see that what we want to secure is a fairly prompt filling up of the space behind the bucket, without the necessity of dragging a lot of water from the casing a along the barrel B, and we shall see that we can dispense with the projection K altogether by so disposing our various parts that water shall enter behind the bucket with promptitude, and shock shall be cushioned by means of the air itself, whose removal it is the object of the pump to effect. Such a design is that of Fig. 3.

A solid bucket works in a shell B. This is perforated by numerous slats arranged in a series of rings, as shown, all round the body of the barrel. Each series of perforations communicates with a separate chamber in an outer casing, which is bored to receive the turned barrel or shell B.

Each of these separate outer chambers $c\ c\ c$, etc., is fitted with india rubber disk-valves, opening toward the pump barrel, and shutting with any pressure from within. The whole of them are in direct communication with the condenser, and the pump discharges through valves as at a, in Fig. 1.

The action of such a pump is as follows: Any movement of the bucket in either direction draws water and air from the condenser through some of the chambers $c\ c\ c$, and, as each set of perforations is uncovered by the movement of the bucket, water pours in through them immediately behind the bucket, whilst, as regards the perforations on the advancing side of the bucket, the tendency of the water is to pass through these, thereby closing the valves in the chambers. All the barrel contents on the advancing side are thus forced towards the chamber A, and pass freely away, the bucket on its return stroke uncovering ring by

ring of slots, and drawing in a fresh supply from the condenser, any vacant space behind the bucket being filled by air, which serves to prevent all shock by its elasticity. At every stroke the air is completely expelled by the bucket face traveling clear of the horizontal barrel, so setting free the air to rise in the end chambers.

The above describes one arrangement of such a pump. Modifications will readily suggest themselves to the practical engineer. Thus, for example, the chambers *c c c* might be in two sets, divided by a partition at the horizontal diametral line of the shell or barrel. The upper chambers only would open down from the condenser, the valves in the lower half opening now downwards to the hot well. In the design first described the advantage for pumps of high speed and large diameter would be that the water flowing in all round, would only have to travel inwards a distance equal to the radius of the bucket circle, whilst when pouring in around the lower half circumference, the water has to travel across the full diameter of the barrel, and so has less time to fill the barrel solid with water up to the bucket face.

That horizontal air pumps having the full stroke of the piston, at speeds of 600 to 850 feet per minute, can be made to run with perfect quiet, and absence of vibration, is proved by scores of examples; but it can only be done by attention to the principles here explained. Such a pump seems an excellent vacuum, and is better than a geared or levered pump, by reason of the absence of complication. Needless to say the valves require to be of an easily moved type.

The condenser may be of the usual vertical jet type, as indicated in dotted lines. The bottom of the condenser is occupied by the air pump casing, which in the figure is shown unduly large, as compared with the condenser.

The two hot wells need not be as shown, and would actually be concealed in the general form of the casing, the delivery valves being lower, and the air pump being utilized as a means of returning the water to the reservoir when so required. Both ends discharge, especially in this case, into one outlet, so preserving a uniform and continuous outflow, and avoiding the frequent starts and stoppages of water incidental to a pump of single-acting type.

When delivering under any head, as in returning water to an overhead lodge, there should be a capacious air vessel on the discharge opening upward from the discharge pipe near the pump delivery. Such an air vessel will always keep supplied with air, which comes over in considerable quantities from almost all air pumps, and may so easily be led to keep up the air vessel supply.

It will probably strike most people who read in the *Engineering News* the communication of Jas. Howard, who signs himself General Manager Beals Brake Co., that he is rather hard pushed for arguments to use against the continuous brake for freight train service, when he says "its adoption for all trains, places the management of roads in the hands of their skilled employes, who are thereby enabled to dictate their own wages."

Carried to its logical conclusion, this means that if all skilled labor could be done away with in the operation of railroads, and only ignorant laborers employed, there would be less trouble than with skilled men, which is not only absurd, but directly opposed to commonly observed facts.

The standards of measurements allotted to United States, at the International Conference of Weights and Measures, have been forwarded from Paris with great care, and have been received and receipted for by the president with great formality.

It is said that seven-eighths of the subscriptions to the magazines are from women. This shows good taste on their part.

An Unconscious Case of Centrifugal Pump—Some Bearings Hold Oil—Others Pump Themselves Dry—Friction Pump.

BY JARNO.

The inventor says that he unconsciously made a centrifugal pump.

Gascon asks: "Why do you give the name inventor to one that makes what was not intended? Invention is a high-sounding term to apply to a blunder, though to get over some blunders requires considerable invention. A misstatement is sometimes called unconscious cerebration. A novel published last year is inscribed, 'To my master, the philosopher of the unconscious, Edward Von Hartmann.' Now, we are to have an account of an unconscious case of pump. It is to be hoped that any drifting of mind will not carry us so far from the 'unconscious' as to take us to dreamy thought."

All this because I began to tell the story as it was told to me. By saying simply "maker" instead of "inventor," I will try to stave off a dream.

The result of the pump was to take the oil out of a bearing, which soon roughed up and began to destroy itself. The maker finished one machine, and ran it several weeks without discovering his pump. The same trouble of bearing destroying itself coming

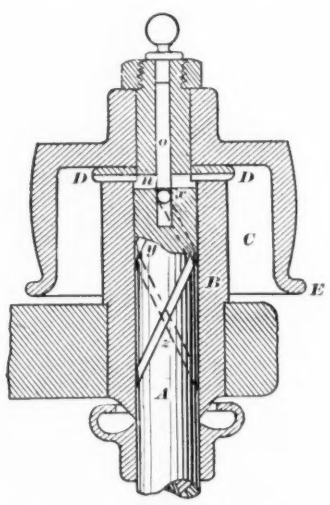


Fig. 1.

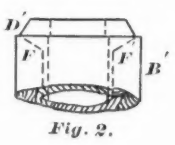


Fig. 2.

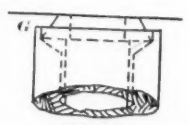


Fig. 3.

in two machines more, he set himself about to find out the cause. He had the far-away look in his eye that belongs to genius under difficulties. The pump was not complicated—to make it no extra parts were added to the machine. Only a shaft, a box, a washer, and, at the starting of the machine, the pump ran into existence. But there were grooves in the under side of this washer, and it was keyed to a shaft that is upright and turns thirty-eight hundred times a minute. In Fig. 1, at *D*, is the collar upon the shaft *A*, which runs in the box *B*, and is driven by the pulley *C*. In the end of the shaft is an upright oil-hole *o* connecting with two cross-holes *n*, *x*, that go through the shaft. The grooves in the under side of *D* were radial, and two of them connected with the cross-hole *n*. The spiral grooves *y*, *z*, in the shaft, connected with the cross-hole *x*. The purpose of the grooves in the washer was to distribute the oil over the upper end of the box—this was the first thing that they did do; the second thing—they took the oil from the box and carried it to the edge of the washer. By having the edge of the washer just over the box, the maker had provided for the complete removal of the oil that got into the hole *n*. It then flew to the inside of the pulley, ran down and flew from the flange *E*, partially covered the maker's ears and nose, and would have gone into his eyes but for his spectacles. Some of the oil from the two last machines caught him looking over his spectacles and did strike him in the eye. The bearing wanted its oil back, and cried out in those peculiar tones that we know so well. It was then that the far-away look came into his eye.

This is the story of the centrifugal pump, showing that whatever oil got into the cross-hole *n* was taken by centrifugal force out through the collar grooves *D*, *D*, and finally thrown off by the flange *E*. Now, there was another action by which oil on the bearing *A* was carried up to the washer, as we shall presently see. However much oil had been put into the hole *o*, upon starting up the machine the bearing soon halloed for more.

The centrifugal pump was done away with by means of the changes shown in Fig. 2. The washer *D'* has no grooves, and, in consequence, the tendency of the oil's being thrown off by centrifugal force is largely reduced; the only hold that this washer gets upon the oil is that of friction. The washer is smaller in diameter than the box, so that it cannot carry the oil off the box. The edge of the washer is beveled, the largest side next to the box, so that whatever oil is thrown off the washer first touches the box, thus reducing the tendency to be thrown completely off. In the top of the box are slanting grooves *FF* leading back to the shaft. With box two inches diameter, and washer a quarter inch less, and with shaft running thirty-eight hundred turns in a minute, only a few drops were thrown off. Practically the centrifugal pump was at an end. In another machine the maker thinks it would be better to have in the top of the box a recess to surround the washer, as in Fig. 3. It is ever thus: Give us but one more to make, and we can do better than before. Should he make

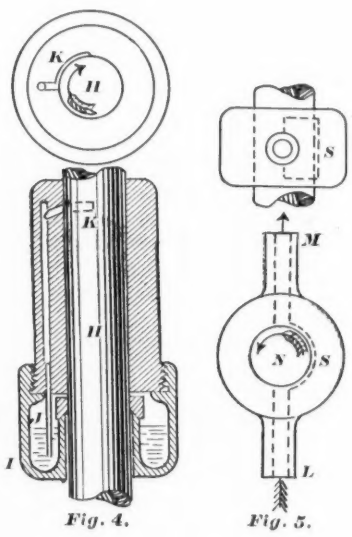


Fig. 4.

Fig. 5.

the recess, he must have the washer thick enough to carry the pulley well above the end of the box, else the oil will still find its way to the pulley directly across the space *G*.

The grooves down the sides of the shaft-hole, in the box, Fig. 2, did away with the other action by which oil had been carried up to the washer. The general statement of this action is, that oil can flow into, or it may be pumped into a bearing by the rotation of the shaft, at a place where there is the least pressure of the shaft upon the box; the friction against the shaft then tends to take the oil toward the place where the shaft presses harder against the box, and it will flow or be pumped out of any hole or opening that it comes to, just before reaching the place of greatest pressure. For years Gascon has noticed this action in the tendency of self-oiling hangers to spill on the side nearest a pulley. Hence we see that the pressure of the pulley, Fig. 1, aided the centrifugal pump in making the bearing behave badly, and that the side grooves, Fig. 2, helped to make the bearing behave well. The oil can run freely down the grooves, and then be pumped up by the bearing. By having the grooves of the right size—not too large—they will not let it run down faster than the bearing will pump it up.

This principle of pumping by friction is employed to make a shaft pump oil to its bearing from a reservoir below. Fig. 4 is an example in which the upright shaft *H* pumps oil from the reservoir *I*, through the tube *J*, to the bearing at the orifice *K* near the top of the box. Starting from the orifice of the oil hole, a shallow groove or channel *K* is cut in the same direction from the oil-hole that the shaft moves, as shown by the arrow and by *K* in the end view. The friction of the shaft upon the air in the channel *K* moves it away from the hole, and its place is taken by oil. When any oil reaches the channel it is also moved along by friction against the shaft, and its place is taken by more oil as long as any oil gets into the lower end of the tube. In this way oil, or other fluid, can be pumped through a height of several feet. The depth of the channel *K* is not a particular matter so long as the channel is gradually beveled at its sides; it is well enough, however, to have its depth not more than three or five one-thousandths of an inch. By having grooves in the box, as in Fig. 3, the oil can be led back into the reservoir, and thus keep up a circulation.

For many years the foregoing method has been used to oil quick-running shafts upon which other methods have failed. Hence it follows that the principle of pumping by friction has long been known. The pumping friction produced by a moving solid near another solid, as between a shaft and its box, does not, however, appear to be so well known as that produced by a moving fluid or gas, as in the atomizer seen in apothecary shops. In 1868 a patent was granted for a self-oiling hanger that made use of the principle that I have described. A re-issue of this patent was granted in 1872. I notice also that early in 1875 two patents were granted upon self-oiling journal-boxes or hangers involving this principle. Of course the claims were for special combinations—one involved a depending tube solid or attached to the lower box, another an arrangement of grooves, inlets and outlets, and still another an independent tube having a concave end and a spring to keep it up to the bearing. The principle has been too long known to be held by letters patent. Gascon says: "To assert that a patent claim covers the principle of oiling by the action of the shaft only, would appear about as reasonable as to claim the action of a prayer-book to reduce friction in a machine shop."

He goes on to state: "We are not sure how a 'self-oiling' box will dispose of its oil until the shaft is run. I have considerable respect for the independence of oil in its wanderings. It is a clean scrap when oil is scraped from a shaft and led back to the well without spilling. 'Self-oiling' boxes are good enough when the conditions do not vary; when the oil well is wider and longer than the box the speed is uniform, one man to tend the box, and he keeps the date of filling. A nurse should go with every machine tool that has 'self-oiling' boxes, unless there is some means of knowing whether there is any oil in the well. At times for several years some of my foremen and draftsmen designed and improved 'self-oiling' spindle-boxes. Just as it was expected that the perfect box was going to be reached, some one proposed to go back to the straight hole leading to the bearing without going down into a well. To this all assented, and I do not expect any farther breaking out of the 'self-oiling' influenza. Sight feeds are good in a steam engine—perhaps a sight oil-well would do for a spindle-box."

A friction pump can be made on the principle shown in Fig. 5. The shaft *N* turns in the direction of the arrow; the inlet is at *L* and the outlet at *M*. The inlet and outlet are connected on one side of the shaft by the shallow channel *S*. Probably this pump would be good to raise oil or water in cutting or grinding machines. By having two inlets and two outlets properly positioned, with valves in each, the pump would act in either direction. It would pump the air out of itself in starting, which is what some pumps cannot do.

Though new to me, yet I cannot assert that the friction pump, Fig. 5, is not old. If an inventor wishes to see himself as others see him, he should look through the Patent Office Reports. In these, ere long, I will search for Fig. 5.

Feed-water Heaters for Large Plants.

Accompanying this are illustrations of feed-water heaters and purifiers, especially adapted to use with steam plants of 500 to 3,000 horse-power. The principle upon which they work is the same as the smaller ones made by the same company, which have been illustrated in our columns, but they are arranged with two tiers of pans, the entering water being distributed equally to them by means of the ribs on the under side of the large pan at the top. By this means a large amount of under surface is secured, upon which, in this system of purification the deposit takes place, without making the pans too heavy for convenient handling.

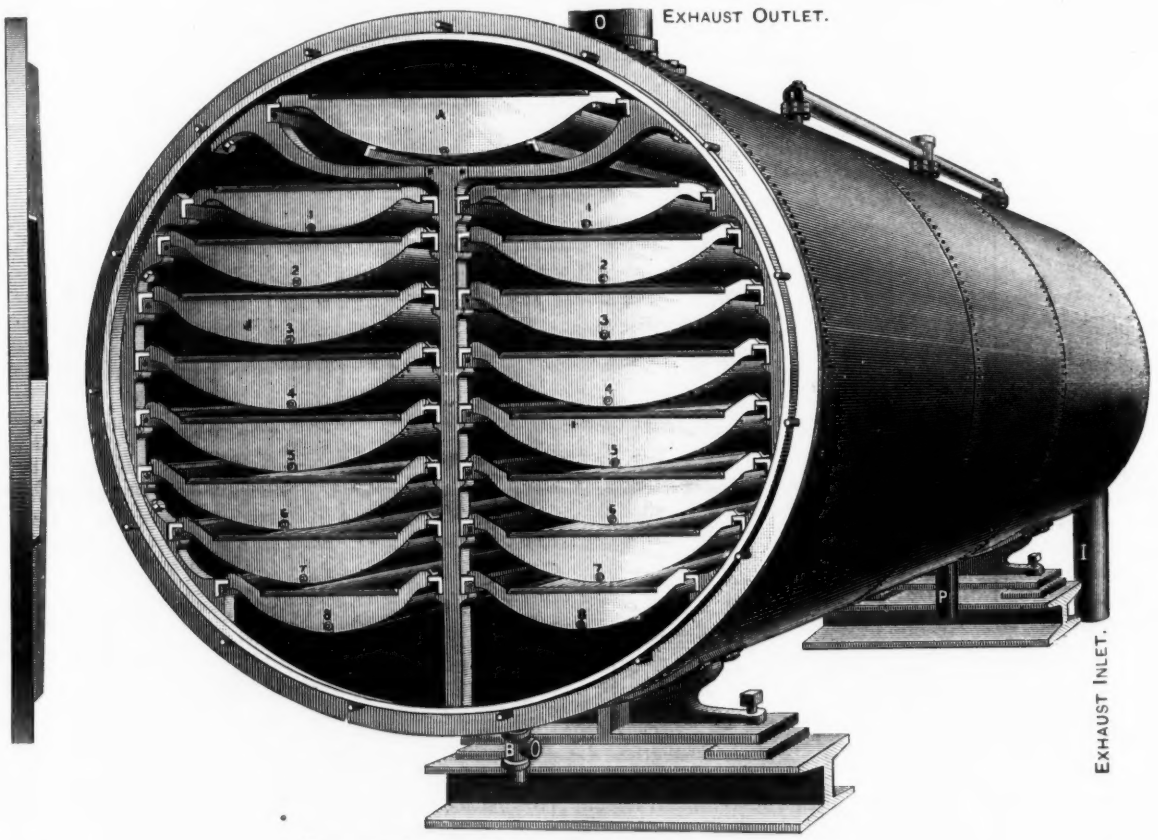
The growing popularity of this system among the owners of large steam plants, where economy is closely watched, has led to the bringing out of this form of heater for those who prefer it, though the company advise the use of two smaller ones, so that one may be in use while the other is being cleaned, thus avoiding the feeding of any unpurified water. The first of those shown is for exhaust steam only, in which style they are constructed in sizes ranging from 700 to 3,000 horse-power. The steam comes into direct contact with the feed water, heating it to the highest temperature possible without back pressure on the engine, and thoroughly removing all carbonates of lime and magnesia, mud, sand, and other solids separated from the water under 212° of heat.

An automatic water regulator, and a means for separating and removing oil, form a part of this heater. The other one is for live steam, and for the separation of impurities not deposited at temperatures below 212°, which usually are the hardest, and therefore the most troublesome scale-forming elements.

It has been found that with many waters an exhaust heater used alone increases the trouble from scale, for the reason that it removes the softer scale-forming elements only, leaving those which, when they go into the boiler, are deposited by the higher heat, and form a much harder and more troublesome scale than would be formed from the water in its natural state; or, in other words, with the softer scale-forming elements left in.

By using the live steam purifier alone, all these impurities are removed; but, unless there is other use for the exhaust steam, it pays in most cases to have the exhaust heater in addition, as the heat of the exhaust steam is thereby utilized, and the process of purification partially completed, leaving less work for the other purifier to do.

The manufacturers are the Hoppes Mfg. Co., Springfield, Ohio.



EXHAUST STEAM FEED-WATER HEATER AND PURIFIER.

The World's Fair.

Interest in the World's Fair project has revived since the hearing of the claims of different cities by the Senate committee. The work of this committee, as well as that of the committee of the House, will only be a partial step forward; but any delay in the action of these committees will delay the action of Congress, and may greatly interfere with the success of the project. If the World's Fair is to be held in 1892 with credit to the nation, there is no time to lose. The architects and engineers will have considerable thinking and scheming to do, and a great amount of calculation, relating to the strength of the different parts which enter into the construction will have to be made, before a final design can be adopted, and a full staff of draftsmen employed; it will require some months before all the contracts can be given out, and all the wheels of industry for the World's Fair set in motion. Hence, if we are to have a creditable Fair in 1892, and avoid all confusion towards the finish, it is of the greatest importance that all preliminary steps be hurried through, and the location of the World's Fair decided upon as soon as possible.

Differential Movements in Indexing.

BY WALTER GRIBBEN.

If the table of differential movements of the B. & S. index plate given in the issue of October 31, 1889, be inspected it will be found that some of the moves on the outside row consist of more than a half turn, and in some cases nearly a full turn. This is rather inconvenient, as there is no sector on the back of the plate, and we either have to count off a large number of holes each time, or rig up some contrivance to answer the same purpose as the sector. After computing the table referred to, it occurred to me that the actual movement of each pin over the plate might be reduced without altering the resultant movement of the spindle by subtracting (algebraically) one whole turn from the forward move, and adding one whole turn to the backward move. This may cause some of the backward moves to be made on an inside row which were formerly made on an outside row, and also on some divisions may cause *both* moves to be made in a *forward* direction. However, if we adhere strictly to the positive and negative signs, there can be no mistake. For instance,

77 teeth calls for	$1\frac{9}{21} - \frac{80}{88}$
Subtracting and adding the whole turn	$-\frac{21}{21} + \frac{33}{33}$
we get	$\frac{9}{21} + \frac{5}{88}$.
Another example:	
138 teeth calls for	$\frac{42}{88} - \frac{99}{88}$
Subtracting and adding the whole turn	$-\frac{33}{88} + \frac{33}{88}$
we get	$\frac{1}{88} + \frac{11}{88}$.
Transposing the terms we have	$\frac{11}{88} - \frac{1}{88}$.

In the case of 77 teeth both moves are lessened in amount, and both are made in a forward direction, while in the case of 138 teeth the moves are not only smaller, but the backward move is made on the inside row. By treating in this manner all the cases in which the move on the outside row is more than a half turn, we get the following table, which is much more convenient to use, and to which some new divisions have been added since the former table was computed. The divisions 91, 174 and 182 were omitted from the first table by oversight, while those of 259, 272, 301 and 308 were subsequently obtained by developing the process beyond the one-hole basis, as explained in the issue of December 12, 1889. Also the divisions 99, 105, 154, 225, 231, 288, 297, 304 and 308 have been abbreviated by Mr. Miller's method of deducing equal fractions from each move. Making these latter deductions led to the discovery that 105 could be cut by a simple movement of $\frac{3}{21}$, but this was probably omitted from the B and S. table by oversight. The division of 360 is also added, although this too may be made by a simple movement.

TABLE OF COMPOUND INDEX MOVEMENTS ON THE BROWN & SHARPE UNIVERSAL MILLING MACHINE.

Number of teeth.	Movements.	Number of teeth.	Movements.	Number of teeth.	Movements.
69	$\frac{21}{21} - \frac{14}{21}$	154	$\frac{8}{21} - \frac{33}{33}$	273	$\frac{24}{21} - \frac{11}{33}$
77	$\frac{9}{21} + \frac{5}{88}$	174	$\frac{14}{21} - \frac{22}{33}$	276	$\frac{24}{21} - \frac{11}{33}$
87	$\frac{33}{21} - \frac{33}{33}$	182	$\frac{5}{21} + \frac{4}{33}$	287	$\frac{15}{21} - \frac{6}{33}$
91	$\frac{3}{21}$	186	$\frac{11}{21} - \frac{11}{33}$	288	$\frac{6}{21} - \frac{4}{33}$
99	$\frac{30}{21} + \frac{44}{33}$	225	$\frac{12}{21} - \frac{3}{33}$	297	$\frac{20}{21} - \frac{15}{33}$
98	$\frac{21}{21} - \frac{33}{33}$	198	$\frac{22}{21} + \frac{33}{33}$	294	$\frac{42}{21} - \frac{36}{33}$
96	$\frac{3}{21} + \frac{2}{33}$	225	$\frac{15}{21} - \frac{20}{33}$	297	$\frac{33}{21} - \frac{22}{33}$
99	$\frac{42}{21} - \frac{33}{33}$	231	$\frac{21}{21} + \frac{33}{33}$	301	$\frac{42}{21} - \frac{42}{33}$
105	$\frac{5}{21}$	253	$\frac{24}{21} - \frac{33}{33}$	304	$\frac{36}{21} - \frac{18}{33}$
98	$\frac{21}{21}$	259	$\frac{24}{21} - \frac{33}{33}$	308	$\frac{24}{21} - \frac{33}{33}$
138	$\frac{33}{21} - \frac{33}{33}$	272	$\frac{30}{21} - \frac{17}{33}$	360	$\frac{3}{18}$
147	$\frac{42}{21} - \frac{35}{33}$				

The sign + indicates that the two fractional movements between which it occurs are to be added together, or, in other words, that they are both in the same direction. The — sign indicates that the second fractional movement is to be subtracted from the first, or, in other words, that the two movements are in opposite directions.

Automatic Couplers and Brakes on Freight Trains.

Those railroad men or others, who may think that automatic couplers and automatic brakes for freight cars are making slow headway, and that their general adoption for freight service is not likely soon to become anything like general, may be undeceived by the perusal of some articles on the subject in the *Engineering News*, of Dec. 21. The articles, together with the maps and illustrations, form a most comprehensive presentation of the subject, well calculated to convince any one who needs convincing on the subject, not only that these improvements are practical and desirable, but also that their use is already sufficiently extended to show very clearly that their practically universal use is only a matter of time, and a shorter time than many have supposed. A double-page map has been prepared by our contemporary, showing in colored lines the roads of the country which have adopted in whole or in part these improvements, and the matter is discussed both from its economic and humane aspects.

The greatest progress seems to have been made in the central States, the far West not showing up so well, while New England falls far behind, as would be expected by those who have had opportunities for comparing railroad equipment there with what is found in other parts of the country. A significant fact is, that there are now about four of the master car builders' standard automatic couplers in use to one of any other automatic type, and that about 40,000 freight cars were equipped with it during the past year.

The Pennsylvania is stated to have about 5,000 freight cars equipped with the automatic brake; the Richmond & Danville, 2,400, and the Michigan Central 1,000. This extensive use, and the fact, that the roads which have had the longest experience with the brakes, under the severest conditions, are applying them to all new freight cars, must certainly be regarded as sufficient proof of the advantages attendant upon their use. No road has yet been found, which has put on either couplers or brakes and has afterwards taken them off.

The completed reform will save the lives of about two thousand trainmen yearly, and avoid serious and distressing accidents to about six thousand more; while viewed from the standpoint of economy, it promises to save from ten to fifteen per cent. in the cost of carrying freight, the figures for this being given in a separate article devoted to that branch of the subject. It is estimated that this saving will result chiefly from the increased speed which it will be safe to give freight trains on parts of the roads suitable for high speeds, by reason of the greater safety resulting from the most efficient brakes and the best couplers. On down grades and level portions of the tracks, it is claimed that, with the improved equipment, it will be entirely safe and proper to let freight trains run at or near the speed of passenger trains, and use the momentum thus gained to help in mounting the next grade, or in making fast time over level track, thus making it possible not only to haul more cars, but to give to every car and engine increased mileage capacity.

The summing up shows the "automatic brake adopted or in extensive use on over 45,000 miles of railway, and in use to a limited degree on over 38,000 miles more, making a total of 45,000 miles." "The M. C. B. standard automatic coupler adopted or in extensive use on nearly 40,000 miles of road, and in use to a limited degree on 14,000 miles more, making a total of 83,000 miles." This, it must be conceded, is a very favorable showing, especially when it is considered that, as our contemporary says: "The greatest fricton in moving mind as well as matter, occurs at the start; and with such good progress already made as we have shown, the ultimate and early success of the movement is assured."

We may add that it seems very likely that the reform will be considerably advanced by legislation before this winter is over, for there is undoubtedly a strong public sentiment in favor of it, which will be very likely to find expression in legislation of some kind; and there can be no doubt but that many railroad officials will be glad to see such legislation, as it will simply compel the doing of what they have for a long time been in favor of doing, but have not been able to do, because of the demands of the stockholders for dividends, or the gamblers of Wall street for the greatest possible reduction of present operating expenses, regardless of any other considerations.

LETTERS FROM PRACTICAL MEN.

About Lathes.

Editor American Machinist:

The articles in your late issues on "lathes," bring to mind a few points I have noticed, and some of which I have so far not seen mentioned.

I would say to "Foot Lathe," that Chase, of Newark, N. J., once built a lathe having all the motions as enumerated, except a larger swing, some 11", if I remember right; this was some fifteen years ago.

I am well aware that many builders are building lathes with a slotted lead screw, and it has been my misfortune to have to use some of them. It is done, so I am told, because it is "cheaper and just as good." To this I take exception; for, while it may be cheaper in first cost than to put in a complete rod feed, yet I think it will be found much more expensive in the end; for when a person has a job that must be bored and threaded at one chucking, I never knew of but one case where the work could be done without changing gears twice for each piece. In my work I have done the feeding by hand, for boring, rather than bother to change the gears, and in one lathe, I remember the feed by friction and with screw thread were so nearly the same that their difference would not be easily noticed.

Since the advent of friction feeds on lathes, I cannot bring to mind an instance where the friction is not preferable to a screw for ordinary turning. You do not have to wait for the screw thread to come along, to allow of clamping the nut, but can run the tool right into the cut clamp friction and the feed begins without a cessation of motion. I think more care should be taken by some builders of lathes in the matter of the gears in the apron; some use cast bevel gears for the one on the rod, and the first gear of train, and not very good ones at that. I have even found this cause so bad in one instance as to leave very decided marks in the turning, from inequalities of feed. I can feel it on traverse handle of a lathe we have, though it does not show in the work; the gear teeth are not full of chips either, for I have just cleaned them.

Whether the lead screw should be on the front or back is still an open question. I like the back best on small lathes, and have at least one eminent mechanic to agree with me—"Joshua Rose," as in his Modern Machine Shop Practice, vol. 1, page 177. The handle to operate the nut should in any case be within easy reach, and should never require a wrench to operate it.

If we would retain the enviable reputation our American tools have secured, we must leave nothing undone to make them handy to use, as well as accurate in use. Some one has well said, "Lost motion in a man is fully as objectionable as in a machine," and I know of my own experience in the use of milling machines, the time spent in hunting for the square to change the crank-wrench from vertical to traverse motion, and in looking up the wrench to operate the set-screws in the gibs of both slides, and further in looking to get the wrench on the screw heads, is all wasted, and the means of overcoming these faults should be looked into by our tool builders. I occasionally have a job of milling, in which it is necessary to change the crank-wrench from one square to the other four times a minute to get into the cut, and the unhandiness of the arrangement I find a great annoyance.

I have always argued in favor of larger spindles in lathes than seems to be the general practice at present, and have been reminded that as large a spindle as I suggested would be very clumsy and would run hard, but I don't believe either proposition, for our milling machine has a spindle nearly 4" diameter in head bearing, and will turn from the unbalanced weight of the nut to clamp the cone and large gear, and will keep in motion fully one minute after throwing off all belts when the speed at the time of throwing them off was 247 revolutions per minute. This is surely easy enough for any speed at which a 16" lathe should run; the large spindle allows of a hole large enough to make it of some use, other than to knock out the center.

Our planers run with narrow belts at high speed, and have an abundance of power, and the belts are easily shifted; why not run lathes on the same plan? The wide, stiff, double belts as used to get the neccessary power on the diminutive cone pulleys now used, are all but impossible to change from one step to another by hand, and make great friction at all times, and I would suggest that the cone pulleys should have a largely increased diameter, as large as would clear the arms of rest in the case of small lathes, making pulley as light as possible, and have a friction brake handle in easy reach to quickly stop, have as many steps for the belt as one dare put on, not less than five in any case. In a large lathe make the cone loose and let it run all the time, starting and stopping lathe by a friction clutch to clamp cone to small gear, which is at present made fast to cone, this gear to carry the connection for driving the spindle direct. This would take off in a great measure the high speed revolving weight and would allow the lathe to be stopped and started quickly when back gears are in use The clutch should be worked from handle on apron, thus always having all handles within easy reach.

Again, I see no reason why the carriage should not be made to travel just one inch at each revolution of traverse handle, as well as $\frac{44}{32}$" in one case and $1\frac{3}{32}$" in another, the lathes being 14" and 16" swing respectively, then in running back to catch threads you could always tell by the position of handle, where to clamp in every time without other guides.

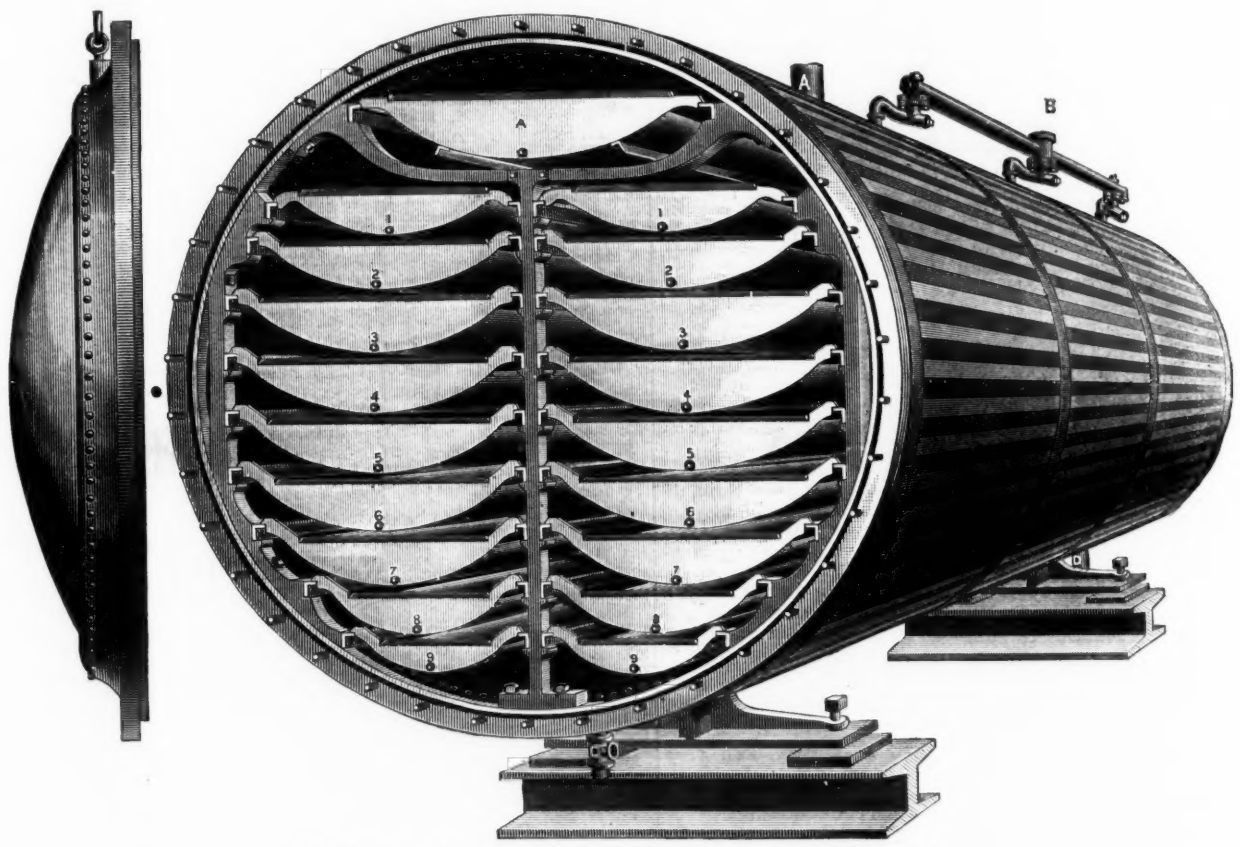
I know of no good reason why the traverse handle of the carriage should be by most builders placed on left side of apron, unless because grandfather built them that way. I have used them on both sides, and used them for years on the left side before I ever got hold of one the other way, yet I like the right side best; for in a large lathe you can get a tool into the bottom of a hole you may be boring and see it all the time, and again I got a severe rap on the head from a chuck jaw in doing that same thing with a 40" lathe with traverse handle on the left, and now think I have one reason very forcibly impressed on my memory.

It seems to me that many of our large lathes are simply overgrown small ones, and that the English practice is to reduce large ones to make small ones, both plans having their failings. CHAS. S. BEACH.

Interchangeability of Lathe Centers.

Editor American Machinist:

In your issue of Dec. 19, 1889, a correspondent writes that he may have an exaggerated idea of the difficulty of securing interchangeability of lathe centers, and then goes on and gives his idea of a lathe center fit. I think your correspondent magnifies the difficulty of securing his ideal fit, and at the same time preserve uniformity. *When a thing is done* it follows as a natural sequence *that it can be done*. The difficulty with my friend, in his experience in making taper holes, was not with his reamers, but rather with his standard for testing the work. I will venture the assertion that, with the aid of a standard taper plug, hardened, ground and lapped, so that it will be a standard in fact as well as in name, there will be no difficulty in making a hundred lathe spindles so that a hundred centers ground to fit a hardened standard hole, which has been ground and lapped to fit the taper plug, will need no fitting to do any work required of the lathe, so far as the fit of the center in the taper hole is concerned. The taper plug goes with the reamer, and the workman, after reaming a hole, tries the plug, and if the fit does not show a bearing the whole length of the hole, the reamer is returned to the tool room for correction, which is done, in most cases, by stoning; but it may have to be ground to correct taper, as per standard hole, backed off and stoned, so it will ream a true hole in soft steel pieces kept for the purpose. All taper reamers have a cover, either of thick brown paper, or tin for large sizes, so they may not be injured by coming in contact with other tools; a wooden rack, with notches in which the tools can be placed when not in use, is a good plan. There should be a duplicate of the standard taper plugs, to be kept by the inspector, by which the spindles should be tested after the lathes are assembled, when any imperfection may be discovered and remedied. We have lathes that the centers have to be fitted to, in the manner my friend speaks of, and marked for that special lathe. We have other lathes for which we make centers in lots of 25 or 50, have them ground to fit a standard taper hole, kept in the tool-room ready for call, and they will fit any lathe of their class without any fitting with a file, because the taper holes in both the head and tail stock spindles were reamed to fit a standard taper plug, such as referred to above. The same result can be obtained by all lathe makers if they have a standard and adhere to it. TOOL-ROOM.



LIVE STEAM FEED-WATER HEATER AND PURIFIER.—SEE PAGE 4.

Kinks for Pattern Makers.

Editor American Machinist:

Where I have beads or rings to put on outside or inside of round patterns or core boxes, that are made in halves, I turn a whole ring, enough larger so that when I saw in two and put in place, it will spring enough to make up for what saw takes out. In this way it can be turned on the screw chuck without the necessity of clamping two pieces together. Of course this can only be done with moderately light rings.

I often save turning chucks for small work, by having screw in chuck run true, and turning hole in outer end of piece, and re-chuck by this hole on screw. I find it works well.

I use my wood bits in lathe, by making wooden chuck in halves to fit head stock, and fit round part of bit for about $2\frac{1}{2}$", and cut out for the square part. I turn this hole, and saw in two, so that it will clamp the bit on the round part.

I bore holes in core-boxes for dowels, all the way through, to prevent sand filling them, and consequent annoyance to the core maker.

I often re-center small pieces in lathes, by setting the rest low, and holding a flat tool over the rest and under the lathe, and bringing tail center up slowly.

I make engine brasses by turning a piece in halves, half the thickness of the brass, with outer boss and hole, and glue the halves together to make proper thickness. I often use the same trick for core-boxes.

I have turned light work by letting the work run between a roller (held rigidly) and the tool—the tool, of course, forcing the work against the roller which supports it.

Use deep hollow planes for round corners to insure uniformity and save time. The desire of an ambitious workman is to do something better or quicker than any one else. JOS. L. GARD.

Light in a Foundry.

Editor American Machinist:

As there are many ways of showing a light in a foundry, I will tell of a new one that I saw. Take a hand ladle and put about a quart or so of coal oil in it, and a piece of waste. If you cannot get that, put a piece of rag in, and light it, and place it in some high position, and it will give light enough for a medium sized foundry where there is no other light.

This will burn for about two hours, and the cost is about 10 cents. THOS. WATHEY.

An alarm compass, the invention of a Boston man, sounds an alarm if the vessel is allowed to get off her course. Electricity is brought into play to accomplish this.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

The Morse Twist Drill and Machine Co., New Bedford, Mass., write us:

The year 1889 has furnished us with an abundance of occupation. We may state that we have been very busy indeed. Within a few months we have added to our buildings, and extensively to machinery and facilities for manufacture, and are at the present time increasing the mechanism within the works. Some new tools will be found in the list to be published. The market for our tools is satisfactorily extending, and now embraces all countries where advancement has been followed by machine shops, and made mechanical devices and properly adapted tools a necessity or a convenience. The prospect for the coming year certainly seems encouraging for those mechanically employed.

The Pratt & Whitney Co. (Machinists' Tools, Forging and Finishing Machinery for Sewing Machine and Gun Manufacture, and Special Purposes), Hartford, Conn., write us:

The value of output has been 11 per cent. greater than in any previous year, and nearly 50 per cent. larger than in 1888. Prices of machine and small tools have not been higher than in 1888, and have averaged lower than in previous years.

During the year there has been no reduction, and very little change in price of labor. There has been an advance in cost of material. Little change in the plant has been made, though it has been used about 1 per cent. overtime.

Our faith in protection to home industries, and so-called raw material, continues unabated.

The Allentown Foundry and Machine Co., Allentown, Pa., write us:

While the first half of the year was not very favorable, we have been quite busy the last half, and especially in our foundry department, and think the outlook very encouraging for the new year.

Montgomery & Co. (Tools, Supplies and Machinery), New York, write us:

During the past year our business has been all that we could anticipate. We are perfectly satisfied with the results of the past year, and can only hope that 1890 will be as remunerative.

There is one thing we would like to see, and that is, better prices. The machinists' supply trade is now so cut up, that the majority of goods are sold on little or no margin whatever.

J. E. Snyder (Improved Quick return Sliding Head Upright Drilling Machines), Worcester, Mass., writes us:

During the year 1889 I have increased my manufacturing facilities by adding a number of new tools; also have more purchased, to be delivered January 1st, 1890. The outlook for business in 1890 is, I think, better than it has been for six years.

The National Machinery Co. (Bolt and Nut Machinery), Tiffin, Ohio, write us:

As to our business the past year, would say that it has been the best year that we have yet experienced, having done nearly one-half more than in '88; and the prospects ahead are quite bright. We look for as good a year as the last, if not better. Our facilities and line of tools are in better shape now than they were in the beginning of '89.

Bement, Miles & Co. (Machine Tools), Philadelphia, Pa., write us:

Our business during the past year has steadily grown, until now, in spite of our extra efforts to increase our output, the accumulation of orders is far greater than at any other time in our experience. You have already published some accounts of the additions to our shops now in progress; these will be ready for business about next May or June, and we shall expect to keep our extended works fully occupied, at least during the whole of 1890. Our capacity for heavy work will then be not less than four times as great as it is now. Unfortunately for us, our space and facilities for large machinery have been so limited that we have been unable to complete the work to our own advantage in cost, or with a sufficient degree of promptness. Our expectation is that before the end of next year we shall have a force of nearly a thousand men, which, with our very much increased facilities for handling, will enable us to execute orders in a reasonable length of time.

Profits are by no means satisfactory, but we trust that they may be a little better by next spring. Tools involving large forgings have necessarily been advanced more than others, owing to a combination among forges to raise prices. The increase in the cost of other materials has not been sufficient to affect our prices to any great extent. Labor is about the same as during the last two years.

We trust that the numerous improvements now being made by all the American builders will result, sooner or later, in extensive foreign trade. The value of American tools has been fully recognized abroad, and it is only their comparatively high cost that has restricted their use in foreign shops.

John S. Leng's Son & Co. (Importers of and Dealers in Iron and Steel, Weldless Steel Tube Co.'s Seamless Cold Drawn Steel Tubes), New York, write us:

Replying to your favor 10th inst., we are pleased to be able to report that during the past year our business has been very satisfactory. The special weldless steel tubes, which we handle, we find more trade for constantly, and our prospects for business during the coming year are very good.

The Joseph Dixon Crucible Co., Jersey City, N. J., write us:

Our business has been larger in every branch than in 1888. Our chief new departure in 1889 has been in the large increase of equipment at our graphite mines at Ticonderoga. We have laid the lines there for a five years' continuous run—tearing down and rebuilding almost everything much larger than before.

The specially large increase in the sales of graphite paint, graphite grease, graphite oils, and other graphite lubricants, has pushed us to this. The sales of our standard and well-known Dixon stove polish, Dixon crucibles, and Dixon "American graphite" pencils have also largely increased.

Our plant now includes 5 steam engines, with a total of 375 H. P.; 9 steam boilers of 600 H. P. together, and the use of 150 H. P. water-power.

We employ 550 persons, and our pay-roll averages $4,500 per week. We have direct connections with the telegraph companies, and the Long Distance Telephone Co.

So far as we can see, the prospect for 1890 is bright.

The Maslin Machine Works (Engineers and Machinists), Jersey City, N. J., write us:

Although we only commenced the manufacture of our patent pulsator steam pumps last July, we are now so pushed with orders for same, that, even with the addition of several special machines for facilitating their manufacture, we find considerable difficulty in filling orders. We are now putting in a number of new tools and intend giving the manufacture of pumps our whole attention. We are also negotiating for the purchase of a foundry to produce our own castings, which will add greatly to this department of our business.

S. A. Smith (Manufacturers' Agent), Chicago, Ill., writes us:

The past year's business has been very satisfactory, and the year is closing with an increased inquiry for goods, and with flattering prospects for the coming year.

The Western Electric are making preparations for largely increasing their business.

J. A. Fay & Co. have leased larger premises at Nos. 22, 24 and 26 South Canal street.

All of my customers report an increasing business.

Job T. Pugh, manufacturer of augur bits, and power boring bits, reports that their business in Chicago has more than doubled the past year.

A. T. Koopman (Fine Tools and Artisans' Supplies, Koopman's Lightning Scales, etc.), Chicago, Ill., writes us:

Our limited capital and capacity is taxed to its uttermost, especially on our "lightning steel rules" for machinists, and our solid steel dividers, and our "guide gauge" for railroad machinists, which, by the way, is the only tool of its kind on the market, and has made a phenomenal record. One of our observing shop agents, who voluntarily takes the trouble to write what he thinks (this is straightforward, entirely unsolicited, unconditional and without mental reservation): "In spite of hard times and short hours (8 hours) your tools are selling well."

We expect to double our capacity soon. But quality first, if it takes every cent we have.

J. Wyke & Co. (Fine and Improved Machinists' Tools), East Boston, Mass., write us:

Our business has been steadily increasing for the last four years, especially in the demand for our patent universal gauges and end graduated machinists' scales; also our metallic T-squares for draftsmen. We have added several new machines and special tools to enable us to get out our work quicker, and with perfect accuracy. We have also put in new steam engine and heater, etc., which doubles our power. The present year (1889) has been very successful with us, and we have a large quantity of orders in hand to commence the new year with.

The Buckeye Engine Co., Salem, Ohio, write us:

Our business for the year 1889 exceeds that of 1888, and during the months of September and October we booked more orders for engines than in any two months since the organization of our company, dating in 1871, and in order to increase our plant, to extend our business and facilitate the execution of orders, we have erected one three-story brick building 100 feet by 50 feet, and have now just completed a brick two-story building 60 feet by 55 feet, and have also increased the number of tools, and have exchanged several for more modern patterns, in view of increasing the volume of our business, and meeting the wants of customers.

The present indications for future orders, ascertained by inquiries and correspondence, are quite flattering indeed. Material used in the manufacture of our specialties is slightly advanced; the price of labor about the same as in '88.

Our sales during the year have been in about all the States and Territories, besides several foreign shipments.

We give you these few points, and you may use such portion of them as you may deem proper.

William Tod & Co. (Engineers, Founders and Machinists), Youngstown, Ohio, write us:

Our business for 1889 shows a moderate increase over 1888, and the prospects for 1890 are in the direction of a very large increase.

During the past month orders for large engines have accumulated very rapidly, and we now have a larger amount of contracts than ever before.

Materials have advanced considerably recently, and labor in a less degree.

The Hendey Machine Co. (Machine Tools), Torrington, Conn., write us:

Our business for the year 1889 has been satisfactory to us, and the prospects for 1890 seem good and promising. During the year we have erected a new forge shop, 35'x55', which has been equipped with a power hammer, blower and other conveniences. To our main building we have built a two story addition, 40'x50', fitted with hydraulic elevator, large scales etc. It has been necessary to re-arrange our tools to a considerable extent, in order to obtain a convenient and economical handling of our work. The additions to machinery the past year include a hydraulic press, universal radial drill, horizontal boring machine, automatic gear cutter, milling machines, drills, planers, lathes and other tools. Our illustrations in the AMERICAN MACHINIST from time to time have shown our line of engine lathes and other new tools. Prices of material and labor have advanced slightly, and prices of our tools remain practically the same. Our export trade is steadily increasing, and is now quite an item of our business. Trusting that our friends of the AMERICAN MACHINIST have also prospered during the year, we remain, with best wishes and the compliments of the season.

The Rue M'f'g Co. Philadelphia, Pa., write us:

We are pleased to report the past year a very satisfactory one in our business. During the year, we have moved our works into a new building, double the size of our former one, and have added some new tools and machinery, and expect to add still more during 1890, to enable us to keep apace of orders for our regular goods, and the increasing demand for our boiler washer and tester; also, 1889 "Little Giant" locomotive injector.

There has been no considerable change in prices of labor and material, or manufactured articles the past year. Outlook for 1890 is very promising.

J. E. Lonergan & Co. (Brass Founders and Finishers, Lonergan's Patent Oilers and Lubricators, Railroad, Machinists' and Mill Supplies), Philadelphia, Pa., write us:

We have no reason to complain of the amount of business done by us during 1889. Doubtless we could have done more had not our attention been divided between our manufactory and building extensions. Our business increased so in 1888 that we outgrew our quarters, which are 17x114 feet, four stories high. We purchased two properties adjoining our own, tore down the old buildings, and erected in their stead a substantial brick and iron structure of "slow-burning construction" 44x114 feet, four stories high, which gives us now a frontage of more than 60x114 feet, four stories high. Unless business shall prove exceptionally brisk we will not be cramped for room for some time to come. We are in a position in point of facilities to do a largely increased business in all our specialties, particularly oil and grease cups, and pop safety valves. We hope, and with indications cropping out we have reason to believe, that the year 1890 will be a brisk year for us.

Conover & Company (Belt Power Air Pump and Condenser, "Victor" Hydraulic Air Compressor, Engines, Boilers, Heaters, Pumps, Machinery, etc.), New York, write us:

We are glad to be able to say that our business during the past year has been steadily increasing, and our customers are so widely distributed over the country that we have moved our office from Newark, N. J., to this city. We are much pleased with the number of inquiries for our belt power condenser. Our engineering business is also very satisfactory, and altogether we think the year 1890 looks very encouraging.

W. P. Davis (Dealer in Machine Tools), Rochester, N. Y., writes us:

Referring to your letter, will say, so far as I am able to judge, business is picking up all over the country. I am getting a large correspondence, which always means business, and it is not confined to any section, as is sometimes the case, but is general. Business for the past two months has been very good indeed with me, and besides machine tools, have sold a large number of engines and boilers. I am now in better position to ship promptly, and to all parts of the country, than ever before, owing to my increased R. R. facilities, since having my headquarters in this city. I am very busy at my works, and while I am running full time, I find that my stock of drills and key seaters is constantly growing smaller, and have found it necessary to put on more help. Regarding machines brought out, I have just been building an entirely new design of surface grinding machine, which I am using at my works, and find it almost indispensable for grinding hardened surfaces that require a perfectly true and straight surface. Am also bringing out a new semi-sensitive drill, being somewhat larger than the so called sensitive drills on the market, and is driven sufficiently strong to use drills from $\frac{5}{8}$" down. Instead of driving direct from spindle by a belt, as is usual in this class of drill, the spindle is driven by gears, one of which is made of rawhide; this gives it great driving strength, and still runs perfectly noiseless. This drill is very simple in construction, having a balanced spindle, and a lever feed. It will be somewhat low in price, owing to the simplicity of construction, and will, I think, be found just what is needed in the average shop. Have also brought out my new iron planer, which has already been illustrated and described in your columns. I make them in sizes from 22x22 to 36x36, of any length desired. On the whole, I have every reason to anticipate a good year's business, and think it will be general for all who can sell good tools at a close figure and deliver promptly. I find this feeling is shared by the many traveling men in my line, that I meet from day to day.

The Sebastian-May Co. (Manufacturers of Foot and Power Lathes, Drill Presses, etc.), Cincinnati, O., write us:

We are glad to be able to say that our business for 1889 has been particularly satisfactory. The demand for our machinery continues to increase, and, in addition to our home trade, we are building up a very satisfactory export business. During the past year we have shipped to many foreign countries.

We continue to increase our facilities, and shall, early in the present year, very largely extend our capacity, and hope to be able to supply our customers with tools of the best quality, and at reasonable prices.

We are very much encouraged with the outlook for business for 1890.

James Hunter & Son (Founders and Machinists), North Adams, Mass., write us:

Replying to your favor of Dec. 10th, will say, we have during the past year built a brick addition to our machine shop 103' x50', 3 stories high, and an addition to our foundry 70'x40'. There has been a good volume of business the past year; much of the time we have been obliged to run our works until 9 o'clock at night, to fill orders for our patent friction clutch pulleys, cut-off couplings, shafting, hangers, and woolen machinery for wet finishing. In consequence of this, we were obliged to increase our works, which we have now running with an increased force of men. We make a specialty of heavy friction clutch work, such as used in electric light plants, factories, etc.

We have our friction couplings in operation, transmitting upwards of 1,000 H. P.

each. We have on hand at the present time several large orders for friction clutches, and the outlook ahead is good.

The Nicholson File Company, Providence, R. I., write us:

Our sales for 1889 will considerably exceed those of 1888. The outlook for 1890 is, for a brisk trade in both our "Nicholson" Regular and "Extra Fine" (X. F.) brands; demands for the latter having grown quite rapidly during the past year.

We have in mind, to meet the growing demand for our goods, an increase to our already large plant, by quite extensive additions, in both buildings and machinery, during 1890, the particulars of which we will give you later on.

Warner & Swasey (Machine Tools), Cleveland, Ohio, write us:

We are pleased to report an increased demand during the last year for our brass working machinery, screw machines and other specialties which we manufacture. We now employ a hundred men, which is an increase of 25 per cent. over last year, having increased our plant in the same proportion.

We are extremely busy at present, and have found it necessary to run extra time, in order to fill our orders.

W. H. Nicholson & Co. (Expanding Lathe Mandrels, etc.), Wilkes Barre, Pa., write us:

We are pleased to say our business for the past year has been very encouraging. We have lately added a 16″ lathe and milling machine to our shop, to keep up with orders, and are now about to add a universal grinding machine, with a capacity for grinding 12″x30″. The demand for our expanding lathe mandrels steadily increases, and we are now making them as large as 8″ and 9″ diameter.

We expect to add several new specialties in the coming year.

The Vanduzen Gas Engine Company, Cincinnati, Ohio, write us:

The year of 1889 has been a very successful one with us, and reached far beyond our expectations; working overtime a part of the time.

We have had several orders countermanded, owing to our inability to get out our engines rapidly enough; but, as we have lately enlarged our factory to twice its capacity, adding a great many new machines of the latest design, we have been enabled to fairly keep up with our orders.

We will have to extend our facilities at the beginning of the year, to keep up with the business. From all appearances, we expect to receive twice the amount of orders in the coming year. We have improved our gas engine so it will use gasoline, as well as manufacture gas. Wages and material have been about the same with us as they have been in the preceding year.

The Lodge & Davis Machine Tool Co. (Iron and Brass-working Machinery), Cincinnati, Ohio, write us:

The year 1889 has been a remarkably busy year with us. We have done a business two-fifths larger than in 1888, and are now in shape to even double this in the year 1890. As your readers have seen from time to time in your columns, we have added a number of new tools to our product, and are improving in the quality of our production continually.

There has been no general change in the price of labor or material in the present year, though we are paying a much larger average of wages in our own shops, in order that our regular force of men may have no temptation to leave us. We believe in keeping the same workmen for all time, if we can get them to stay with us, and are pleased to say we are remarkably successful in this respect.

We have made two advances of 5 per cent. during the year, which seems to have been taken with great kindness by the buyers, and are just putting in force another 5 per cent. advance.

We have not had occasion to discharge a man for lack of work for four years, and are in continual need of good mechanics. We have added one room 80x200 feet for the manufacture of planers, and one room 100x120 feet for a new line of 14″ and 16″ lathes, putting in this department the latest improved machinery that can be bought. We also opened a branch house in Chicago last February, which has gone $30,000 further in its sales than we figured, and is in every respect a valuable addition to our business. We opened at 64 Cortlandt street, New York City, another branch house, Jan. 1st, 1890, and have every reason to believe from our past experience in the eastern market that it will be a grand success.

We still hold the same high opinion of the AMERICAN MACHINIST as an advertising medium, as you have no doubt seen from our increasing our space from time to time.

H. B. Brown & Co. (The Merriman Patent Bolt Cutters, Davis' Patent Bolt Headers and Nut Tappers), East Hampton, Conn., write us:

The year 1889 has been an advance upon the previous year in the volume of business that we have transacted, and in the profits derived therefrom. The demand for our machinery, both at home and abroad, has increased; and we enter upon the new year encouraged to hope for a still greater expansion of our trade. In view of this prospect, we are preparing new improvements in our machinery, and modifications and changes in our patterns, that will make our product still more acceptable to the users of bolt and nut machinery.

During the last quarter, our orders have so increased that, whereas we had expected to carry a surplus stock over into the coming year, we find our supply pretty nearly cleaned out, and the field cleared for the campaign of 1890.

We note not much change in our payments for labor, materials, etc. On the whole, therefore, we enter the new year with a sense of encouragement and confidence.

The National Pipe Bending Co. (The National Feed Water Heater, Coils and Bends of Iron, Brass and Copper Pipe), New Haven, Conn., write us:

The business of the National Pipe Bending Company has increased very largely during the past year, both in the line of the national feed-water heater, and in coils and bends of iron, brass and copper pipe.

The sales of feed-water heaters for the year 1889 will reach five hundred. Since last August we have kept an extra force of men at work, and for the last three months have been obliged to work evenings. We have taken in addition the shop next us, and during the next spring and summer shall build to our present shop in order to obtain better facilities for our coil work.

The Cleveland Twist Drill Co. (Twist Drills, Reamers and Small Tools), Cleveland, Ohio, write us:

In order to make a few repairs, and to put in place some new machinery, we will close our factory between Christmas and New Year's days; will also take inventory. Our new shops, into which we moved one year ago, are already full of machinery, and we are contemplating building additions.

Chas. A. Strelinger & Co. (Hardware Tools, Supplies and Machinery), Detroit, Mich., write us:

We moved about six months ago in our new stores. Our room has been increased nearly three hundred per cent., still we do not find that we have any room to spare now. The work of moving and changing our stock was considerable of a task, and was made much more so by our business constantly increasing in amount. The past year has been a satisfactory one to us, and we expect to have a good business during the coming year.

The Capitol Manufacturing Co. (The Adams Patent Automatic Bolt Threading, Nut Tapping and Pointing Machines), Chicago, write us:

The demand for our bolt threading machinery and other specialties, during the last year, has grown very materially, and the prospects for the coming year are the best. We have now on hand enough orders to keep us going for some time. We are erecting a new factory 125′x125′, four stories, the basement being 16′, and the second floor 14′ high. These two floors will be entirely used for the manufacture of our bolt threading machinery. We are putting in new machinery, and are making a number of new patterns to supply the continually growing demand for different styles and sizes of our machinery.

Donald Fraser (Patented Specialties), Milwaukee, Wis., writes us:

Business is good as could be expected, as, on account of bad health, I have been unable to push it as I would like. I find an increasing demand for my goods, and will move into larger quarters before spring.

Machine business was never better in this city than at present, all shops running overtime, with demand for machinists, pattern makers, moulders, etc., constant.

The Gordon Steam Pump Co., Hamilton, Ohio, write us:

Our business for the past year has been exceedingly good. We have been pushed for the whole year almost to the extent of our facilities. The outlook for 1890 is good. We expect a large increase in our business.

The Universal Radial Drill Co., Cincinnati, O., write us:

The year just closing has been one of materially increased business to us, and we will begin the new year with an accumulation of unfilled orders. We have worked a larger force than before, have added several tools to our plant, and improved our facilities and methods. We have revised our designs, and have put upon the market several entirely new machines during the year. We find materials are hardening in prices, wages have advanced, and that the buyer is more ready to pay full value for machinery than last year.

Incidentally we beg to advise you that today we are shipping to Lagnano, Italy, one of our largest machines, and that the buyer advises us that he became acquainted with them first through the AMERICAN MACHINIST.

The P. H. & F. M. Roots (Rotary Blowers, Portable Forges, Fire-beds and Tuyere-irons, Gas Exhausters and Fittings), Connersville, Ind., write us:

Our business in rotary force blast blowers, rotary gas exhausters, blacksmith hand blowers, rotary pumps, rotary water motors and portable forges has been greater during the year of 1889 than ever before. Since 1887 we have entirely remodeled our works, doubling our facilities in buildings and machinery, and we find it as difficult to keep up with our orders as we did before any facilities were added. The outlook for 1890 is very encouraging, and we anticipate a still larger trade than the past year. Price of materials has advanced somewhat during the last few months.

The New Doty Manufacturing Co. (Hand and Belt Power Punching and Shearing Machines), Janesville, Wis., write us:

The past year has exceeded that of any previous year. We have recently increased our facilities about 50 per cent., and have now all we can do. The prospects for trade in 1890 are very flattering. Machinists' wages are higher with us than a year ago.

Acme Machinery Company (Bolt, Nut and Special Machinery), Cleveland, Ohio, write us:

The year of 1889 has been one of prosperity, and the outlook for 1890 is bright. We have completed the shops we started last winter, which now gives us 28,000 square feet of floor space for shop room, besides separate buildings for raw material. We have also added quite a number of machine tools during the year, as well as a Sturtevant hot blast heating apparatus for heating our entire plant.

Besides building the well known Acme bolt cutters, we have also perfected a new improved bolt header, of which we are now ready to supply three different sizes, for heading bolts, rivets, etc., ranging from ¼ to 2½″ diameter.

Labor and material are somewhat higher than a year ago, but we have not changed the prices of our product thus far.

The Crescent Steel Company, 480 Pearl street, New York, write us:

The present year has been quite an active one in the demand for fine steel; old and regular customers have bought freely, and a good many have been convinced that there is no necessity of going outside of this country for such steel as will do the hardest work called for.

Prices have ruled low, too low, in fact, for a fairly profitable business, but the competition of manufacturers who run more to quantity than quality of production, has made it at times difficult for those who have maintained a high standard in the latter respect to convince consumers that low-priced steel for tools is generally very dear at any price, when the loss in time and labor in making tools, or continually sharpening them, is taken into account.

We notice an increased demand for fine steel of high temper, for tools that are required to do hard and continuous cutting, and this is directly in the line of the increased work which all machine tools are now required to do, it being necessary to turn out the utmost amount of work per man, or per tool, which the establishment is capable of, in order to see any profit in finished goods marketed at current prices.

There has been a sharp advance in the price of low-grade steels during the past three months, which has led many large consumers to contract for their supply at the current prices, and to this extent, their orders will be out of the market for some time to come.

S. W. Goodyear (Wire Pointing Machinery), Waterbury, Conn., writes us:

Thanks to the advertisement of my wire-pointing and reducing machine in the AMERICAN MACHINIST, the stream of inquiry has been quite constant for the past seven or eight years. As an advertising medium it stands, in my judgment, in the front ranks, and, that the AMERICAN MACHINIST is read all over the mechanical world, it is only necessary to look at the postmarks on inquiries. They have come to me from all parts of the United States from Maine to California, and Canada, England, France, Scotland, Germany, Austria, Russia, etc., have been represented in the mail matter drifting into my box.

J. A. Fay & Co. (Wood-working Machinery), Cincinnati, Ohio, write us:

Our business for 1889 has been exceedingly satisfactory, our shipments being 15 per cent. larger than for the year previous. We have run our works full time—ten hours per day—during the year, and have employed a full force, every nook and corner in our buildings being occupied by men and material. We have replaced a large number of our old tools by new and improved machines, and have also purchased a large number of new machines, thus making quite an increase in our equipment.

During the year we made a large exhibit at the Paris Exposition, where we occupied a space of almost 80 feet long by 40 feet wide. It certainly was the best display that we have ever made at any Exposition in the past, and the results have been extremely satisfactory. During the Exposition we booked a large number of orders for machines, which we have been shipping to our customers in different parts of the world. In addition to this, at the close of the Exposition we succeeded in disposing of almost all our display to customers in France and England. We were awarded a "Grand Prix," this being the first time that this medal has ever been given to wood-working machinery, although Messrs. Perin & Co., of Paris, have received the same award in the past on band saw blades. Finally our president, Mr. W. H. Doane, who is still absent in Europe, received the decoration of the Legion of Honor for the many improvements which he has introduced in wood-working machinery, these improvements being illustrated by the display which we made at Paris.

From all standpoints, we think the year has been the most successful that we have experienced in our history as a company. Trade at the present time is good, and we are crowded with orders in every department of our works. Prices, however, during the entire year have been extremely low, and for this reason we are compelled to continually study up new ways, introduce new tools, and make our machines in large quantities, so that we may furnish our customers with better tools at exceedingly low and very reasonable prices.

The outlook for next year we consider very good, and we find there is a continued and increasing demand from all parts of the world for machines containing the latest *improvements* and quality, quantity of work and the economical production by the machines we sell, is considered much more now than formerly. The demand seems to be increasing for heavy and much more expensive tools than we could sell in former years.

The Syracuse Twist Drill Co., Syracuse, N. Y., write us:

The year past has been quite satisfactory in amount of business, being a healthy growth over any previous year. We have increased our facilities and are still adding new machines. We consider the prospect good for the coming year, and anticipate some difficulty in keeping up with the demand for our goods, as we have not been able at this season to accumulate any considerable stock. Our prices have been kept quite regular, although some of our competitors are reported as bidding for enlarged trade by cutting prices. There has been no noticeable change in the price of material or labor from a year ago.

Ferracute Machine Company (Presses, Die, and other Sheet Metal Tools), Bridgeton, N. J., write us that:

In addition to their regular line of presses and dies, they are building considerable automatic machinery for various purposes. They havelately built a large number of automatic machines for compressing tablets for the drug trade, have brought out a new form of "milk shaker," and are now at work on a patent oil-measuring machine.

They are about to commence on a batch of new nail machines for making nails from tin scrap. They have already built two or three of these machines, and the last one in the improved form is running very successfully in one of the large tinware establishments. This machine produces excellent nails very rapidly from almost any kind of scrap, and seems to be a subject which is of considerable interest to the tinware and can manufacturers, not only in the United States, but many foreign countries. The Ferracute Machine Co. have had a great many inquiries from all parts of the world concerning it, and they anticipate that they will build a large number during the coming year.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, JANUARY 16, 1890.

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College or Machine Shop.

Shall we enter the college or the machine shop? This is often a perplexing question to those who are about to learn the engineering profession. Any one who can have the advantage of a college education, and also a thorough practical training in the machine shop, is placed in very fortunate circumstances, and if the opportunities offered are not neglected, a position in the foremost ranks of the profession may be expected. But there are always many ambitious young men who cannot afford to go to college, and the only course left to them is to start in the machine shop. Such a course should in nowise be discouraging; for, if these young men have the ability and energy to apply themselves severely to their task, they are bound to advance in their profession. The experience and the drill to be obtained during the day will be of the greatest value to those who strive to become either first-class mechanics, draftsmen, engineers or proprietors; and with the many opportunities offered for obtaining a scientific knowledge in the evening schools, or by studying the many excellent books written by eminent authors, and keeping well posted in the new inventions and progress made in the mechanical arts, reported in many technical journals, there is no reason for preventing any one from obtaining an equal footing with a college graduate. Yet we warn those who study at home, not to fall into a common error of trying to grasp too much at once, but start where a public school education has ended, and proceed slowly, step by step. This course will make the acquirement of knowledge easier, more thorough, and in the end save time. Too many irons in the fire at one time is liable to end in failure. In pursuing a regular course of study at home, not more than two or three subjects should be taken up at a time, and a special evening devoted to each study; and an evening now and then for recreation is also advisable. In colleges great stress is laid on the integrity of character, and in this respect the young man who studies at home cannot afford to be an inferior. Honesty, truth and sobriety should always be courted, thereby obtaining a grip on an honorable and successful business career. To those who can afford to go to college, we say, do not lose the opportunity, and when the course is finished do not imagine that the acquirement of knowledge is exhausted, but go to work in the machine shop and learn more, apply the knowledge previously obtained to the advancement of the mechanical arts, and use it for the benefit of mankind.

Activity Among the Trusts.

There seems at this writing to be an unusual degree of activity among the trusts; many new ones are being formed, while those already in existence are busily engaged in boosting prices up beyond the point at which natural and free competition would fix them. A good many of the materials used in building have been thus advanced in price, and one of the latest trusts organized is that of the window glass producers. A press dispatch says:

"This combine, which embraces every factory of any standing in the United States, places the window glass business well to the front as one of the greatest trusts now operating in this country. Hereafter buyers of window glass must pay higher prices than at any time within the last five years."

A cheerful prospect, truly, for the mechanic who had hoped to be able to build himself a modest home during the coming season. Nor will the manufacturer be entirely without emotion when he contemplates the increased cost of glass and other materials for his projected new factory or shop. In these days, when the value and importance of light in manufacturing operations are fully understood, and the number and size of windows in new shops regulated accordingly, the cost of glass is no inconsiderable item. And when it is well known that a large portion of his glass bill is a clear steal, he is apt to think that trusts are not unmixed blessings, even if he himself belongs to one, while, if he does not so belong (as will usually be the case with a manufacturer of machinery), he will be apt to conclude that they are unmixed evils.

The electric lighting companies seem to have in store for them something which some of their officers are likely to regard as much more serious than the cutting down by the authorities of a few miles of wires. The superintendent of one of them has been indicted for manslaughter, for causing the death of a man named Henry Harris. The language of the indictment is something of a curiosity. It charges that Mr. Pierce (the superintendent) "with force and arms, in and upon the body of one Henry Harris, then and there being, willfully and feloniously did make an assault, and a current of electricity of great and deadly power and intensity, through and into the body of him, the said Henry Harris, then and there willfully and feloniously did put, place and pass, and cause and procure to be put, placed and to pass, and the said current of electricity through and into the body of the said Henry Harris, did then and there willfully and feloniously keep and continue, and cause and procure to be kept and continued for a space of time . . . a mortal electric shock, of which said mortal electric shock he, the said Henry Harris, then and there died."

Is it any wonder the man died?

The thousand or more men employed at the works of the Warder, Bushnell & Glessner Co., at Springfield, O., of which the well-known engineer, Chas. A. Bauer, is the general manager, gave during the holidays a very pleasant testimonial of their appreciation of his management, in the form of a bronze statue, symbolical of the business in which they are engaged, and which was quietly left in the office during the temporary absence of the proprietors, accompanied by a letter expressing the kindliest sentiments of friendship and good will.

This is something of a departure from the usual program in such cases, and does away with the feature of speech-making, which those who have them to make, usually feel are among the things which had better be left unsaid. An additional cause for congratulation in this instance is the recent purchase by the company of the exclusive right to the manufacture of the machinery, which they have heretofore shared with two other concerns; which will, of course, result in a largely increased business.

Andrew Carnegie, it is said, will furnish the money to rebuild the public library destroyed by the flood at Johnstown, Pa. This is a very commendable act on his part, since there are no claims on him for doing it. It must be a satisfaction to a man of Mr. Carnegie's means to unload some of it where he can see it do good while he is living. His heirs will not quarrel over the money that goes to rebuild that library, and it will go right on doing good after he is dead. If men would consider the example of the late Peter Cooper, who was one of the happiest men in New York, there would be more public libraries built from overflowing pocketbooks, and fewer from the bequests of wills.

When the recent International Marine Conference met at Washington, it was very generally believed that many important changes in the rules governing vessels at sea would be recommended. As a matter of fact, the conference recommend practically no changes at all. This will be disappointing to a good many, who thought that safety would result from several important changes; but, when the conference came to carefully consider the matter, it found grave objections to them all. But the conference has not been in vain; the fact that it could suggest nothing better than existing rules will restore confidence in these rules.

The Arthur Kill Bridge was formally opened New Year's day, by running the first train across it. This gives the Baltimore & Ohio a way to New York Bay, an end which it has long desired, but was prevented from attaining by the opposition of other roads. The fact that the B. & O. can now reach New York with comparative ease is directly in the interests of the people.

Literary Notes.

THERMODYNAMICS OF THE STEAM ENGINE AND OTHER HEAT ENGINES By Cecil H. Peabody, Associate Professor of Steam Engineering, Massachusetts Institute of Technology.

This work is designed to give instruction to students in technical schools in the methods and results of the application of thermodynamics to engineering. The presentation of the general theory is that employed by many other writers. The chapters on thermal capacities, first law of thermodynamics, non-reversible processes, fundamental equations, perfect gases, saturated vapor, superheated steam, flow of fluids, contain valuable information, and will be interesting to students familiar with higher mathematics. Calculus has been freely used, and most practical men will find these chapters difficult to read. Considerable space is devoted to the injector, wherein it is described, its theory and action explained, and tests with tables given. Here the practical man will find valuable information, which he can apply to every-day practice. The feature in which this book differs most from similar works is in the treatment of the steam engine. The approximate theories based on the assumption of adiabatic changes of the steam in an engine cylinder have been avoided, and instead of this there is given a systematic study of steam engine tests, with a view of finding what is actually known on the subject, and how future investigations and improvements may be made. For this purpose a large number of tests have been collected, arranged and compared.

Directions are given for testing engines, and for designing simple and compound engines. There are also chapters treating on the friction of engines, compressed air and refrigerating machines, with many useful tables. The author's tables of properties of steam and other vapors may be considered to be an integral part of the book. Engineers will find this book to be a valuable addition to their library; the very complete index makes it a handy book for reference. Others, who are not familiar with the higher branches of mathematics, will probably not regret the price paid for it, even if they do not understand the whole of it. The book is published by John Wiley & Sons, 15 Astor place, New York. Price, $5.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(18) W. C. L., Worcester, Mass., asks: How can I determine the diameters of two cone pulleys with two or more changes? *A.*—See AMERICAN MACHINIST, Dec. 1, 1888, page 2. 2. How can I find the length of belts? *A.*—See our issues of July 14 and 21, 1888.

(19) G. S. C., Mechanicsburg, Pa., asks: Would you proportion ports and valves of a low-pressure cylinder for a compound engine in the ordinary way? *A.*—Yes. 2. Where would you cut off steam in that cylinder? *A.*—The valves should be set so that the initial strains and work done are equalized between the cylinders.

(20) W. H. K., ———, writes: I am a lathe boy in a locomotive shop, and wish to learn all I can about the lathe. Will you please name two or more good modern books on the subject? *A.*—We know of no book devoted to the lathe, though there are a number which treat of lathe work along with kindred subjects. We really do not think much is to be learned from books about lathe work. We infer that you are already a reader of the AMERICAN MACHINIST, and you will find in its columns from time to time, discussions of such matters by practical mechanics, and this, together with investigations and study of your own, will help you along better than anything else.

(21) H., Worcester, Mass., writes: In the article relating to Force in the Steam Engine, etc., Prof. Torrey says: "We also know that the greatest velocity of the reciprocating parts is reached before the midstroke of the piston." I don't see where in his previous articles he shows this to be so. Will you kindly explain? *A.*—See article on "Relative Velocity of the Crank-pin to that of the Piston," in our issue of January 9th, current vol ume.

(22) B. B., Rutherford, N. J., writes: What is the cause of bubbles rising from the bottom of my water glass, running rapidly to the top of water level, and sometimes carrying the water clear to the top of the glass? This occurs while the engine is ruuning. Steam pressure in the boiler is 80 pounds. *A.*—It seems to us that your boiler is priming; the probable cause is that the steam space in the boiler is too small, or the water carried too high. Priming may also be caused by forcing the boiler to do a greater duty than it was designed for. Whatever may be the cause, it is a dangerous occurrence, and should be overcome at any cost.

(23) H. B. W., Freedom, Pa., writes: Please inform me as to the cause of trouble with our pump. We have a pipe 200 feet long to low-water mark in the river, and we lift 18 feet. When the water in the river is low the pump works all right, but at high water the pump pounds and does not seem to fill. When I stop a few minutes and start again she will run smooth for a short time only. The water end is 5 inches bore; suction, 4 inches; discharge, 2½ inches. Four feet from pump I have 10 feet of 4-inch pipe on the suction pipe for an air chamber. I have no foot valve on the end of the suction. Would one be advantageous? *A.*—At high water you have a greater pressure against the suction valve than at low water, and since you have trouble only at high water, it seems to us that the suction valve has not sufficient time to close against the increased pressure, therefore the lift of the suction valve should be examined; you will probably find it to be too high, and should be reduced. A foot valve on the suction we believe to be advantageous.

(24) Gearing, Warren, Ohio, writes: Please give rules for proportioning arms of elliptical cross-section for gear wheels, also the thickness of rim. Please name book containing such data. *A.*—To determine the dimensions for cast-iron gear arms having elliptical cross-sections, multiply the pitch radius by the force transmitted, multiply the product thus obtained by 0.00339, and divide the result by the number of arms. This gives the product of the minor into the square of the major axis. In symbols this rule will be as follows: Let a represent the major axis; b the minor axis; P the force in pounds transmitted; R the pitch radius: and n the number of arms; we have

$$a^2\, b = 0.00339\, \frac{P\, R}{n}.$$

The ratio between the major and minor axes is arbitrary, but often we find the minor axis equal to one-half of the major axis, or $b = \frac{a}{2}$. Adopting this proportion, the foregoing formula will reduce to

$$a^3 \times \frac{a}{2} = 0.00339\, \frac{P\, R}{n}, \text{ hence } \frac{a^3}{2} = 0.00339\, \frac{P\, R}{n},$$

and $a = \sqrt[3]{\frac{0.00339 \times P \times R \times 2}{n}}$, which gives the width of the arm near the hub. The taper recommended by authorities varies from $\frac{1}{32}$ to $\frac{1}{8}$ on each side of the arm. For the thickness of the rim, *Reuleaux* gives the following formula:

$$t = 0.12 + 0.4\, p,$$

in which t is the thickness of the rim, and p the circular pitch. Hence, to determine the thickness of the rim of a cast-iron gear wheel, multiply the circular pitch by 0.4, and to this product add 0.12 of an inch. You will find the foregoing data given in the Treatise on Toothed Gearing, by J. H. Cromwell, Ph. B.

(25) H. W., Dennison, O., writes: Please give me a rule by which I can find the horse-power of an engine. *A.*—Multiply the mean effective pressure in pounds on a square inch of piston by the length of stroke of piston in feet, multiply this product by the area in square inches of the piston, and again multiply this last product by the number of strokes made by the piston in one minute, and lastly, divide this total product by the 33,000; the quotient will be the indicated horse-power. Probably the following formula will help to impress this rule on the memory: Let *I. H. P.* stand for indicated horse-power; P for the mean effective pressure in pounds on a square inch of piston; L the length of stroke in feet; A the area of the piston in square inches; N the number of strokes made by the piston in one minute. We then have

$$I.\, H.\, P. = \frac{P\, L\, A\, N}{33{,}000}.$$

Here it must not be understood that the word *PLAN* has any particular relation to the horse-power of an engine, but the letters forming this word should simply be understood to be symbols of the factors which enter into the calculation; neither does it make any difference in which order we take the factors, but, placing them in the order here given, they form the word *PLAN*, which may help to impress the rule upon the memory. The divisor 33,000 stands for that many foot-pounds. An engine which raises 33,000 pounds through one foot in one minute is said to exert one horse-power. This unit of horse-power was established by Watt, and has since been adopted by the universal consent of English and American engineers.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Iron Planers from 16" to 36" wide by any length. H. C. Pease & Co., Worcester, Mass.

Machine Screw Taps of all sizes and threads, manufactured by S. W. Card & Co., Mansfield, Mass.

Patent Attorney R. G. DuBois, 715 11th st., Wash., D. C., procures first-class patents for inventors.

Valve Seat Rotary Planing Machine. Pedrick & Ayer, Philadelphia, Pa.

Cylinder Boring and Facing Machines. Pedrick & Ayer, Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 12, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

25" to 42" Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

25" to 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

Just concluded. "Practical Drawing." By J. G. A. Meyer. Copies of the AMERICAN MACHINIST containing the above series of 93 articles sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies 5 cents each. AMERICAN MACHINIST PUBLISHING Co., 96 Fulton st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G Co., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the AMERICAN MACHINIST containing the entire set sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies 5 cents each. AMERICAN MACHINIST PUBLISHING Co., 96 Fulton st., New York.

Patterson, Gottfried & Hunter (Lim.), 146-150 Centre st., N. Y., carry a complete stock of Brush, Copper, Celluvert Fiber, Oiled Paper, Hard Rubber, Rod & Sheet Brass, Brass, Copper & Iron Wire, Self-Hardening Tool Steel, Set & Cap Screws, Machine Bolts, Machine & Wood Screws, Taps & Dies, Files and Twist Drills, Blowers & Forges, Machinery, Tools & Hardware, Gear Wheels, Wood Pulleys, Shafting, Hangers and Belting. General factory supplies.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15" to 88" swing, planing machines 48"x45"x10', 52"x50"x12', 17"x14"x24', 72"x69"x24', and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel, also steam hammers and two 8"x16" and one 10"x20" Rider cut-off engines.

MANUFACTURES

Rauch, Crush & Co. will build a wagon factory at Fincastle, Va.

B. W. Walker will build at machine shop at Milledgeville, Ga.

Efforts are being made to start a watch factory at Watertown, Dak.

Eighty-three vessels have been built in Maine during the past year.

The Norfolk & Carolina Railroad Co. expect to build shops at Norfolk, Va.

The Chesapeake Shirt Company, Baltimore, Md., will move its factory to larger quarters.

The Denison (Texas) Light and Power Company has been incorporated, with a capital of $125,000.

The American Roller Bearing Co., capital stock $1,000,000, has been incorporated at Chicago, Ill.

A company has been formed to build waterworks, and an electric light plant at Lake Charles, La.

The contract has been let for building the Tallapoosa Foundry and Machine Works, at Tallapoosa, Ga.

W. T. Tompkins will build a saw-mill at Ocala, Fla.; will probably put in wood-working machinery.

The Gaston Lumber Co. will build works at Cadillac, Mich., for the manufacture of wooden novelties.

A. V. Thompson & Co., manufacturers of jeans, at Louisville, Ky., have been granted a charter of incorporation.

A. H. Anthony has just started a new machine shop at Jewett City, Conn., and will build light machinery and tools.

The Galena (Kas.) Foundry and Machine Company are going into the manufacture of the McLane friction hoister, for use in the mining districts.

The water company at St. Joseph, Mo., has increased its capital stock from $400,000 to $2,500,000. The system will be extended and pumping capacity increased.

The Phosphor-Bronze Smelting Co., Philadelphia, Pa., has issued an 1890 catalogue of their products. It contains price list, weight of round and flat bronze, etc.

The Economy Car Door Co., of East St. Louis, Mo., has been incorporated, with a capital of $150,000, to manufacture car doors. The incorporators are: John C. Wands, C. T. Westlake and Spencer Munson.

The Buffalo Forge Co., Buffalo, N. Y., has issued a pamphlet entitled, "What People Think of Us." It contains a photographic reproduction of letters of commendation from those using Buffalo blowers and fans, printed on tinted paper. It is neat and unique.

J. F. Foard and others have organized a stock company to purchase the old wagon manufacturing plant of Cherry, Morrow & Co., at Nashville, Tenn., and manufacture wagons under the patents of the Kentucky Wagon Manufacturing Company, of Louisville, Ky.

The National Iron Works, New Brunswick, N. J., are making large shipments to Russia of machinery for manufacturing rubber goods. The order was secured after the Russian agent had visited Germany, France and England, he giving preference to the American machinery.

An application for a charter has been made by Percy F. Smith, J. J. McCormick, William Macrum, George Glass, and W. A. Rahn, for a company to be known as the Chartiers (Pa.) Valley Electric Light Company. They propose to put in a plant near Chartiers, Pa., and light all the towns in the valley.

There is water-works agitation at Port Falls, I. T.; La Grande, Ore.; St. Joseph, Mo; Canton, Ohio; Helena, Mont.; Binghamton, N. Y.; Nashville, Tenn.; Norfolk, Va.; Atlanta, Ga.; Peoria, Ill.; Pulaski City, Va.; Portsmouth, N. H.; Cottage City, Mass.; Camden, N. J.; Coldwater, Mich.; Romeo, Mich.; Newton, Mass.; St. Louis, Mo.

The citizens of New Hamburg, Ont., propose to grant a bonus of $25,000 to the London Tool Works of London, Ont., of which Messrs. Yates & Gibson are proprietors, on condition of that concern removing to New Hamburg and employing not less than forty men. They are to erect buildings of the value of $10,000, and are to pay the interest annually of the balance of $15,000.

The F. H. Foster Manufacturing Co., hardware, will build at Fort Payne, Ala., the following buildings: A finishing factory, 3½ stories, 50x150 feet; boiler and engine-house, 40x50 feet; brass foundry, 40x60 feet; fireproof vault, 30x50 feet; iron foundry, 50x150 feet; rolling and japanning foundry, 40x100 feet; foundry storehouse, 35x45 feet; general storehouse, 40x75 feet, and pump-house 20x30 feet.

The Electric Railway, Light and Power Company, of Topeka, Kansas, has been incorporated, and filed its charter with the Secretary of State. The company is formed to build an electric railway. The capital stock of the company is $150,000. The officers and directors are W. E. Sterne, president; D. C. Metsker, secretary, treasurer and manager; R. R. Moore, A. B. Wolverton and D. O. McCray.

The Springfield (Mass.) *Republican* says: Business at all the shops in Orange (Mass.) was never more brisk, all running on full time with full forces of help and with orders enough ahead to last into the summer. The New Home Sewing Machine Company was not able to furnish all the machines the agents wanted for the holiday trade. Good tenements are scarce and rent high. Over 100 building lots have been sold to people who intend to build early in the spring.

George Layberger, formerly a brass roller at the rod mills of Carnegie, Phipps & Co., at Beaver Falls, Pa., has formed a partnership with several capitalists of Pittsburgh, and the plans are now being drawn for an extensive rod mill to be located in that town, if the proper grounds can be secured. Several acres of ground free of charge have been offered to them north of Beaver Falls, on the proposed line of the connecting line of the Baltimore & Ohio and Pittsburgh & Western Railroads.

The year 1889 was marked by a good business in the shipyards of Baltimore, and 1890 promises to be yet more active. In 1889 eleven vessels of different classes were launched, representing 4,719 tons, and valued at $566,375. A recapitulation of the new vessels now under contract is, two steel cruisers, one iron oil-tank steamer, one iron revenue steamer, one composite propeller, one side-wheel steamer, one four-masted schooner, two three-masted schooners, one tug-boat, one barge, a total of eleven vessels, representing over $3,000,000.—*New York Evening Post.*

The W. & A. Fletcher Company of New York city, builders of marine engines, etc., are erecting new shops at the foot of 14th street, Hoboken, N. J. The machine shop will be 196x70 feet; smith and flange shop, 55x90 feet; boiler shop, 55x200 feet; pattern shop, 30x80 feet. The boiler shop is to have a hydraulic plant, and a traveling crane is to be placed in the machine shop. They will also have a pier for the convenience of placing the machinery in ships. It is expected that the shops will be completed during the month of May.

The Capitol Manufacturing Co., Chicago, Ill., make the following announcement: We take pleasure in notifying our patrons and friends that we have removed to our new factory on Rees street, near Halsted street, and kindly ask that all letters be addressed as above. Owing to the large increase in the demand for our goods we have abandoned our old plant and erected a new factory especially adapted to our business, and thereby greatly increasing our facilities. Our new factory is very conveniently located; we have a four-story building, 125 feet square, with a basement 16 feet high, the second floor 14 feet, and the other floors 12 feet high. New machinery has been added, and old machinery replaced by the most modern appliances, and hereafter we will be able to meet promptly the constantly growing demand for our goods.

It has at last been definitely decided that the Grant Locomotive Works will change its location from Paterson, N. J., to Chicago. Representatives of the company have purchased a section of land in the town of Cicero, adjoining Chicago, and eleven acres besides, on which the works will be erected. Mr. E. T. Jeffery, late general manager of the Illinois Central road, will be, it is said, prominently connected with the management of the works. The buildings are to be erected at once, and it is expected that, by the latter part of this year, they will commence to deliver locomotives. The capacity of the works will be 250 locomotives a year, and it is expected that from 1,200 to 1,500 men will be employed. Two companies are to be organized, each with not less than $800,000 nor more than $1,000,000 capital stock. One will be the Grant Locomotive Works, which will have to be incorporated anew under the laws of the State of Illinois, the other will be a land company.

A Trenton (N. J.) dispatch says: The negotiations for the establishment of a rubber trust in this city are about completed. British capitalists, it is said, are to take an interest amounting to about $3,000,000, and to push the sale of the stock in England and Scotland. The identity of the capitalists has not yet been disclosed, but they are believed to be the same men who bought up a number of American breweries recently. The negotiations for the establishment of the trust began about two months ago, when, in response to an offer of an English syndicate, Thomas A. Bell, of the Star Rubber Company, and Frank A. Magowan, of the Trenton Rubber Company, were appointed as representatives of the local rubber interests to investigate as to the advisability of such a movement. Mr. Bell went abroad and found the syndicate to be reliable. Two accountants were sent over here to investigate the rubber companies in turn, and their report, which was favorable, has been approved by the managers of the syndicate. There are eight rubber companies in Trenton.

Machinists' Supplies and Iron.

NEW YORK, Jan. 11, 1890.

Iron—American Pig.—The action of the Thomas Iron Co., in fixing their new scale of prices, has had the effect of making the business more steady, and has put things generally in a more definite and satisfactory condition. The market rules quiet. The demand at the furnaces has been somewhat more quiet than would be expected, principally on account of the offerings from second hands, of stocks bought somewhat below present quotations. Then, too, there is considerable iron yet due on old contracts. Foundry grades have been in moderate demand, with furnace deliveries held at $20 to $20 50 for No. 1 X, and for No. 2 $19 to $19.50.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Good machinists, and one or two pattern makers. The Pond Mach. Tool Co., Plainfield, N. J.

Wanted—An experienced tool maker. The E. Ingraham Co., Bristol, Ct.

Wanted—All kinds of mechanical drafting made at nights, by exp'd man. A. G. AMERICAN MACHINIST.

Wanted Exp'd mechanical draftsmen. State ability and salary. Balto. Sug. Ref. Co. South Baltimore, A. A. Co., Md.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

Wanted—Foreman boiler works who can manage about 25 men and get out good work at lowest cost. Address A. J. P., AMERICAN MACHINIST.

A competent mechanical draftsman and machine designer will be open for engagement in a few weeks. Address BOX 70. AMERICAN MACHINIST.

Machinists Wanted—First-class vise and machine hands of good habits, can find steady employment and liberal wages Address Morgan Engineering Company, Alliance, Ohio.

Wanted—Capitalists, or a syndicate, to take hold of and operate in the foreign countries a valuable invention for finishing iron and steel. Address "Machine," AMERICAN MACHINIST.

A thorough machinist and good draftsman, having had sole responsibilities of shop's management for years, exceptional references, open for engagement. Address F. I. P., care AMERICAN MACHINIST.

Wanted—Foreman for machine shop employing 15 to 20 hands on nice work, in a town 20 miles west of Philadelphia. Permanent position to careful, systematic, energetic man. Address "S.," care AMERICAN MACHINIST.

Wanted—A thoroughly competent time-keeper for an iron works employing five hundred men. One who understands keeping both day and piece-work time. State age, experience and salary. Address BOX 69, AMERICAN MACHINIST.

Man Wanted—To take charge of our brass foundry as foreman. Must be experienced in mixing metals and moulding in all details. Address, with references, The National Cash Register Co., Dayton, Ohio.

Wanted—Foreman for a modern machine shop near Boston, Mass., running twenty-five men on medium weight machinery. Must be an energetic man that can turn out good work, and lots of it. State salary wanted and experience. Address M. M., care AMERICAN MACHINIST.

Wanted—Mechanical engineer, experienced in designing and building modern automatic high-speed engines (plain and compound). One who is capable of taking charge of correspondence, and acting as general manager of office and shops Location, Southern Pennsylvania. BOX 64, AM. MACHINIST.

Wanted—Superintendent for pipe mill The applicant must be thoroughly acquainted with all the details of the pipe business, must be able to construct and run either Bell, Butt or Lap-Weld Furnaces. Must understand the use of natural gas as fuel, and all that pertains to Siemens Furnaces. Apply to Oil City Tube Co., Oil City, Pa.

Wanted—Engineer to take charge of the engines and machinery in an electric light station in the West, running about 1,200 H. P. Corliss and high-speed compound condensing engines. State experience, age, and give references. A first-class man can secure steady employment and good salary. Address D. W., care AMERICAN MACHINIST.

Salesmen can add to their incomes by selling our goods on commission. Commissions to one salesman, who devoted only one hour daily to our goods, averaged twenty-five dollars per month for the past three months. Our goods have been on the market for twenty one years, are well known, and are first-class in every respect. Address Box 72, AMERICAN MACHINIST.

Wanted—2nd-hand indicator; must be cheap and in good order. Address I. A. Resh, Phillipsburgh, N. J.

Foundry desiring to add a paying specialty with well establ'd trade, address Box 192, Honesdale, Pa.

Wanted—To buy an established machine shop with modern tools and good business, situated in N. Y., Conn., or Mass. Tools, AMERICAN MACHINIST.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

For Sale—An established mach. business, protected by valuable patents. Can be much enlarged by judicious management. C. M. W., AM. MACHINIST.

For Sale—1 Wilkinson pat. crank-pin oiling device, 3 visible feed-bearing cups. Address I. A. Resh, Phillipsburgh, N. J.

Simonsen-Walter Mfg. Co., Jefferson City, Mo., with modern foundry, machine and wood-work plant, wants spec. to manuf. for Western trade.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—To sell our interest in a machine shop and foundry. The interest will invoice about $8,000.00. Will guarantee a profit of not less than 15 per cent. on the investment to a good business man. Reason for selling—have other interests that require my attention. Address J. Ed. Guenther, Owensboro, Ky.

For Sale—One 14-foot boring and turning mill, with two heads and pulley attachment, 10-foot table, and an attachment for boring and turning pulleys up to 20 feet diameter. This tool was made by the Niles Tool Works, and is in excellent condition. For further particulars call or address Southwark Foundry and Machine Co., Washington ave. and Fifth st., Philadelphia, Pa.

✝ MISCELLANEOUS WANTS ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion.

¾" Portable Drill, $100. Am. Tool W'ks., Clev. O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

BRADLEY HAMMERS AND FORGES.

The BEST HAMMERS in the WORLD RUN BY BELT.

Over 1500 In Use.

Three Styles, 15 lb. to 500 lb. Heads.

Our FORGES heat irons fast enough to keep Hammers and men fully employed.

Send for Catalogue and Prices.

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63 Murray St., NEW YORK. 98 Sudbury St., BOSTON.

BOOKS FOR MECHANICS.

Fitzgerald's Boston Machinist. 18mo, cloth..... $ 75
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Thurston's Friction in Machinery. 8vo..... 3 00
West's Foundry Practice. 12mo, plates..... 2 50
West's Moulder's Text Book. 12mo, plates..... 2 50
McCord's Practical Mechanism. 8v..... 5 00
Wrinkles and Recipes for Mechanics and Engineers..2 00

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THREE DESIGNS, SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
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Lathes 22 inch to 72 inch swing.
Planers 26 inch to 84 inch wide.
Special Characteristics: Great weight, Great Power and Excellent Workmanship.

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The only micrometer that will not lose its accuracy by wear.
Satisfaction Guaranteed.
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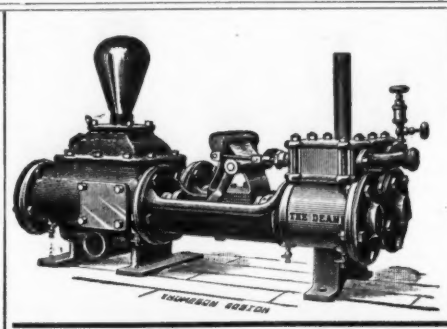
Syracuse, N. Y.



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HOLYOKE, MASS.,
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STEAM and POWER
PUMPS
FOR ALL PURPOSES.
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Drill Rods. Sheet Steel. Fine Wire. Machinery and Spring Steel. Forgings. Coiled Springs. Die Blocks. Steel for Hardware of all kinds.

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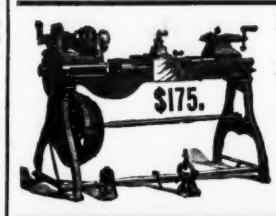

Improved Screw Cutting Foot and Power LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO., 167 W. 2d St.,
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Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORCED HOT.
Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Ingot metal for car and engine bearings. Spring wire.
ANSONIA BRASS & COPPER CO.,
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Send for Circular. CHICAGO. NEW YORK.

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JESSOP'S BEST TOOL STEEL
Gold Medal, Paris, 1889.
Importation Orders Promptly filled.
ALL KINDS OF Steel in Stock.

"Star" Foot Lathe Swings 9x25 in. | LATHE | Screw Cutting Automatic Cross Feed, etc.
LATHE
Scroll Saws, Circular Saws, Lathes Mortisers. | LATHE | Catalogue Free of all our Machinery
Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y.

Iron Planers from 16" to 36" wide by any length.
H. C. PEASE & CO.,
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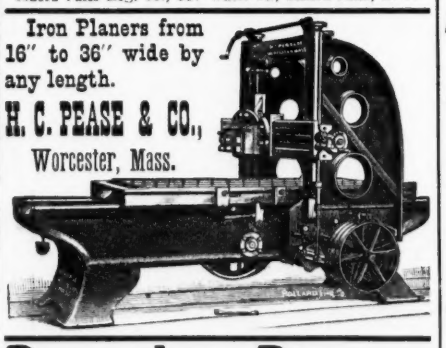

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Following sizes carried in stock:
20 in., 22 in., 24 in., 26 in. & 30 in.
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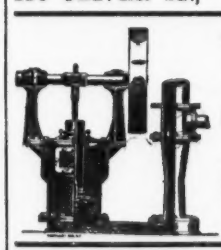

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CONSULTING AND MECHANICAL ENGINEERS
95 LIBERTY ST.,
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No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*

STANDARD OIL CUPS.
FOR HIGH SPEED ENGINES & MACHINERY. DYNAMOS.

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Maslin's Patent Pulsator Pump.
PAT. FEB. 12, 1889.
Cheapest and Best Automatic Steam Vacuum Pump. Handling DIRTY and GRITTY LIQUIDS without Wear, Oil or Care. Simple, Economical, Efficient & Durable. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining & General Hydraulic Purposes. Write or call for Circulars. JOHN MASLIN & SON, SOLE MANUF'RS, 165-167 1st St., Jersey City, N. J.

IF YOU WANT A STRONG, ECONOMICAL
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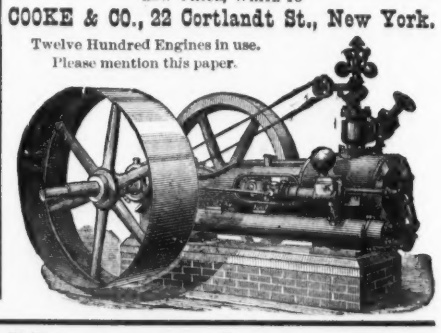
EITHER HORIZONTAL OR VERTICAL,
FOR STEADY EVERY DAY AND ALL NIGHT SERVICE AND AT A LOW PRICE, WRITE TO
COOKE & CO., 22 Cortlandt St., New York.
Twelve Hundred Engines in use.
Please mention this paper.



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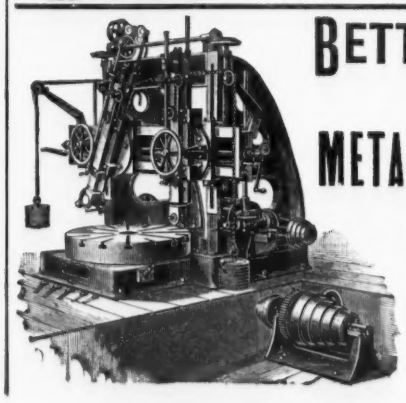
WATER WORKS PUMPING ENGINES A SPECIALTY



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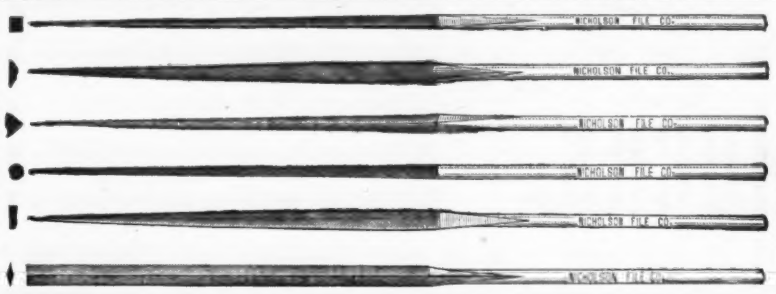

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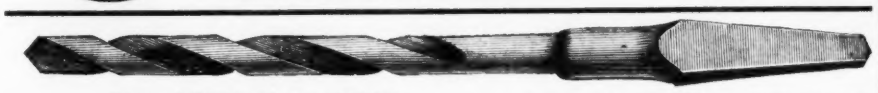

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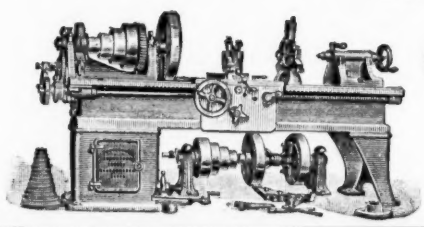

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MANUFACTURERS OF
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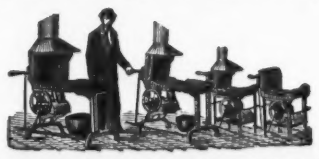

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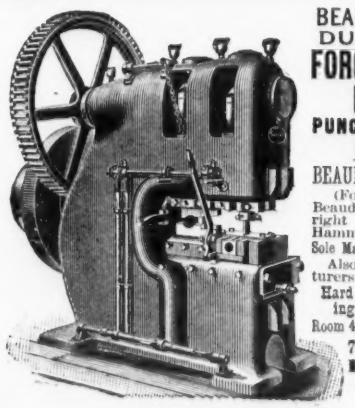
Slow-speeded, Force-blast. Durable, Compact and Cheap.
Roots' Foundry Blowers, Gas Exhausters, etc.
S. S. TOWNSEND, Gen. Agt. } 22 CORTLANDT ST.,
COOKE & CO., Selling Agts., } NEW YORK.
In Writing, Please Mention This Paper.



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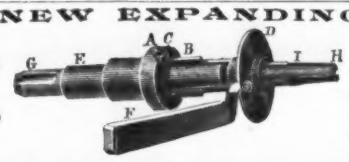

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No.		Price.
1	⅛ to ¾	in. $10
2	1 " 1¾	" 14
3	1½ " 2	" 18
4 (with screws)	2 " 3	" 32
5 " "	3 " 4	" 44

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SPECIAL MANDRELS FOR SPECIAL JOBS MADE TO ORDER.
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Boiler Feeders, Duplex Pumps,
Fire Pumps, Send for Catalogue

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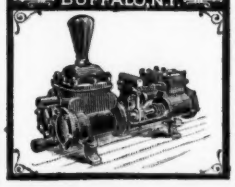

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NEW PULSOMETER,
CHEAPEST & BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.
More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.
Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A 1 Testimonials. Mailed Free.
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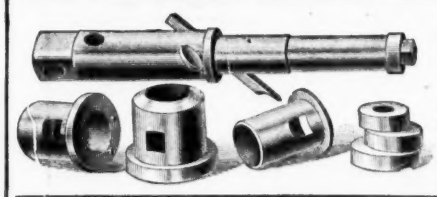

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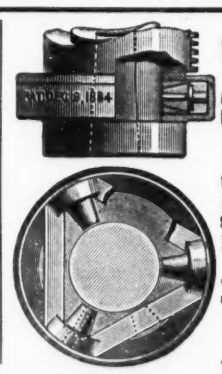

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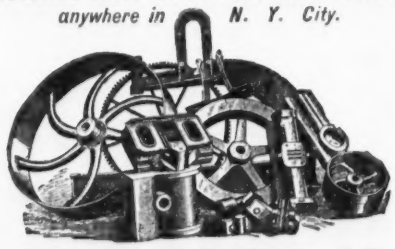

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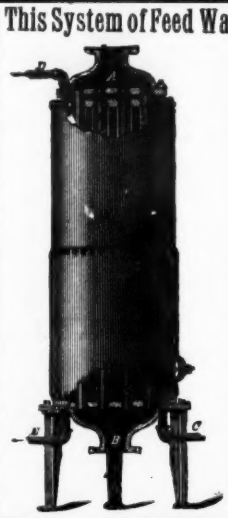

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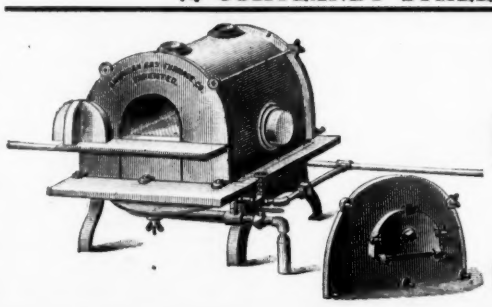

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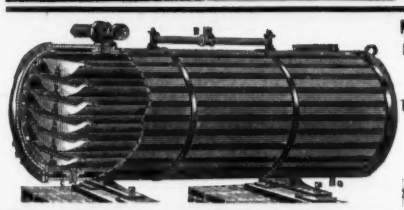

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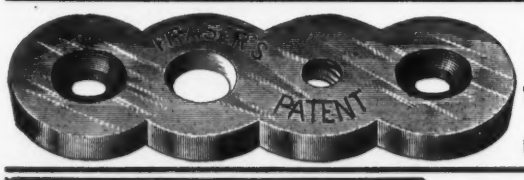

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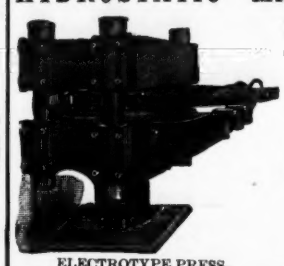

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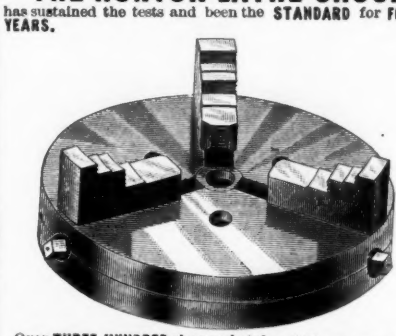

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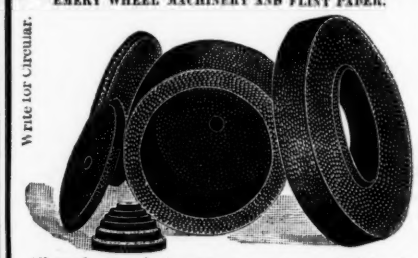

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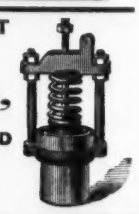

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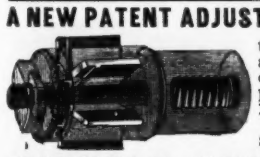

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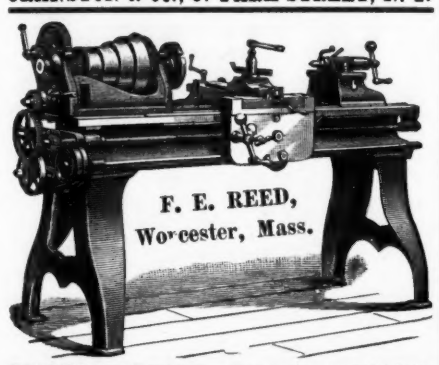

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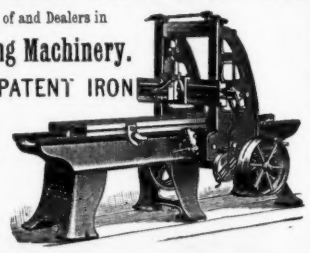

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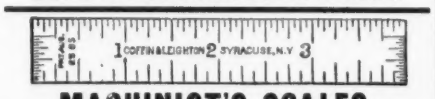

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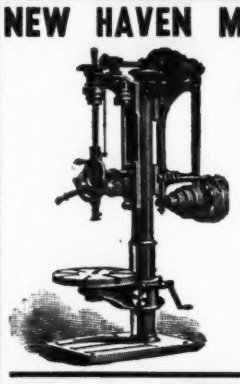

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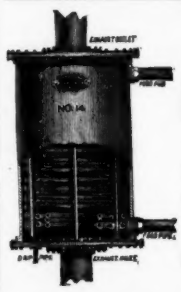

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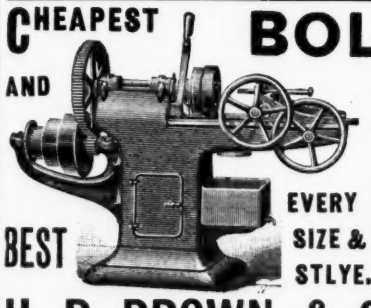

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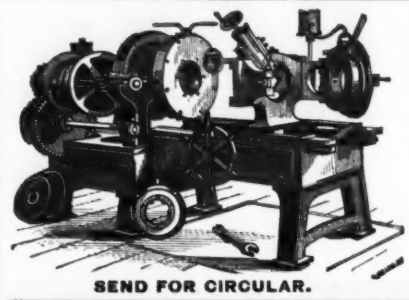

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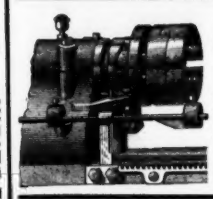

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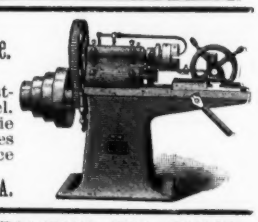

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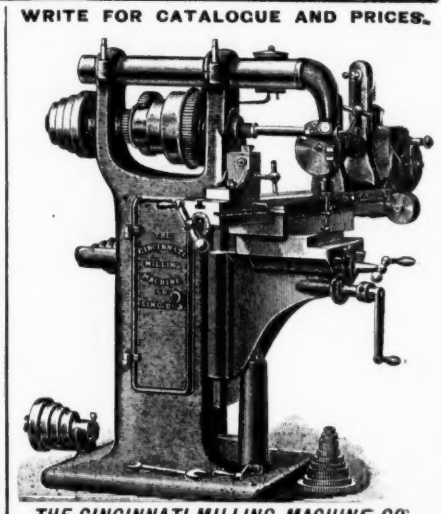

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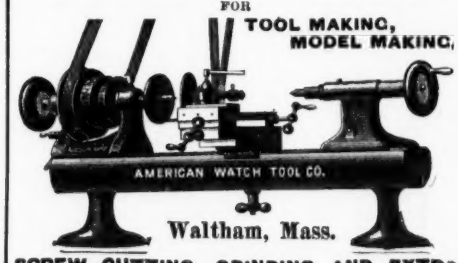

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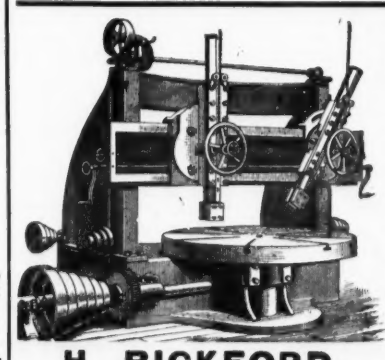

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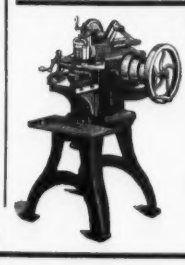

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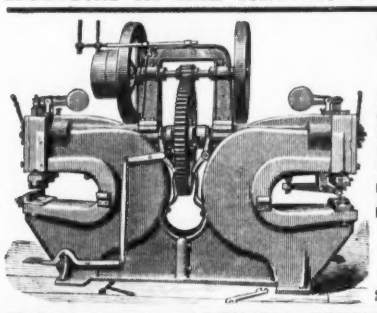

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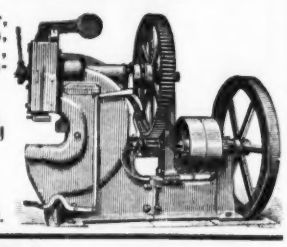

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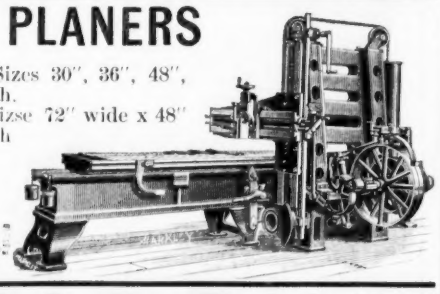

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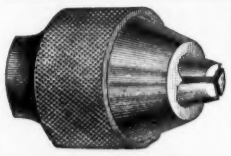

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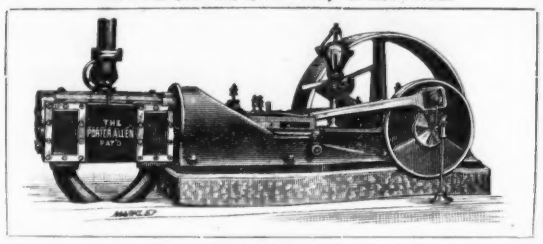

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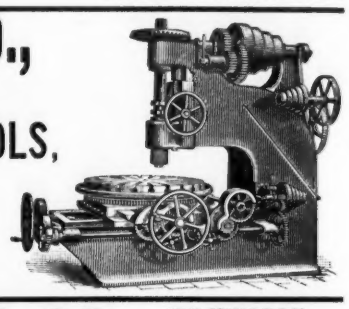

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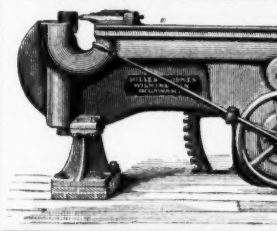

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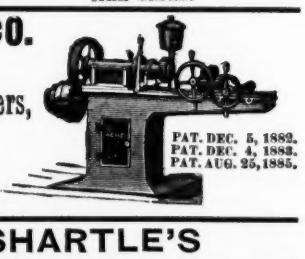

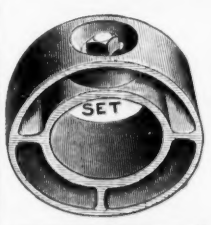

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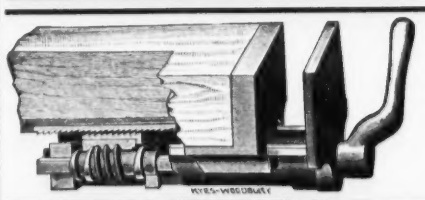

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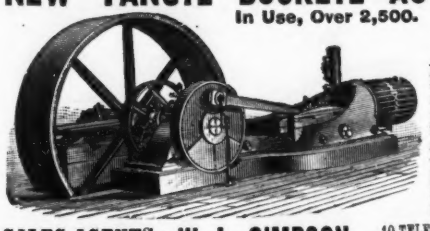

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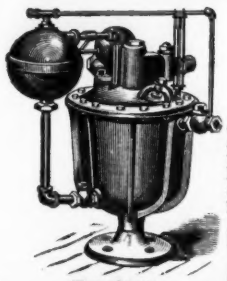

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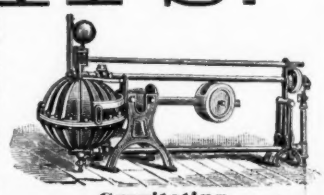

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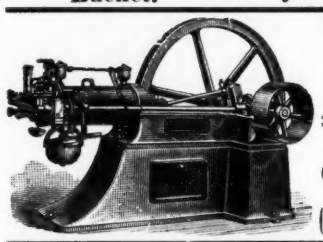

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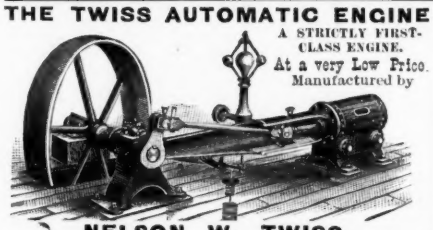

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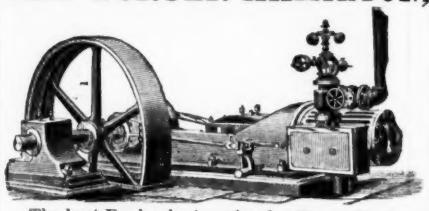

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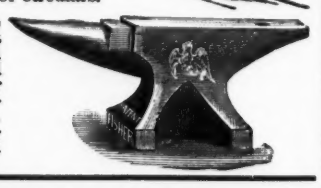

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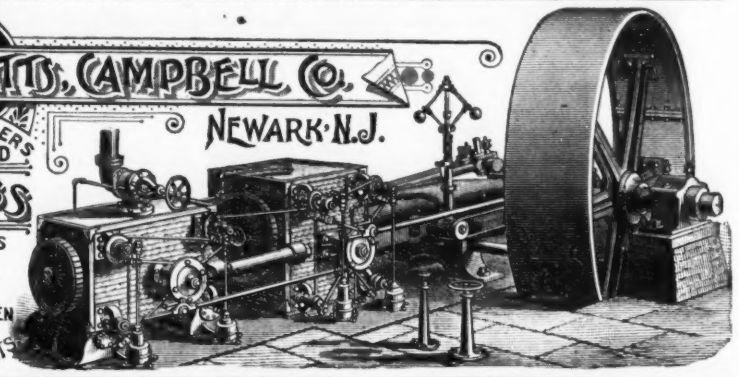

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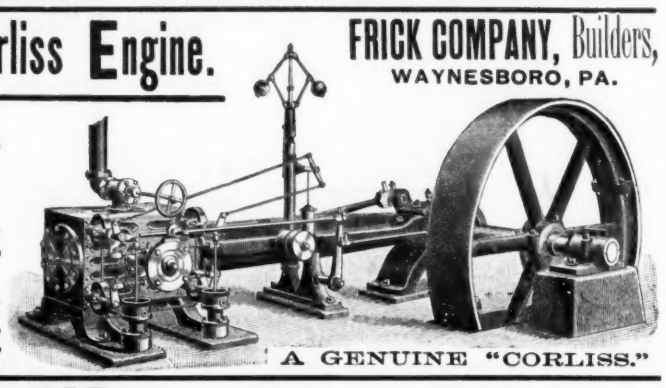

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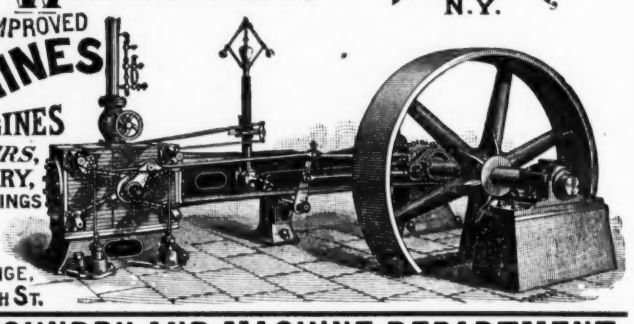

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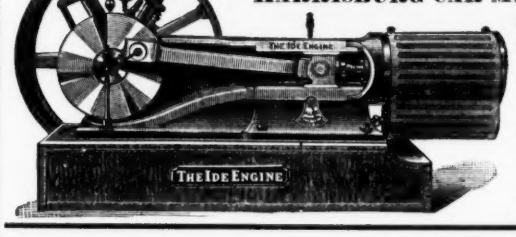

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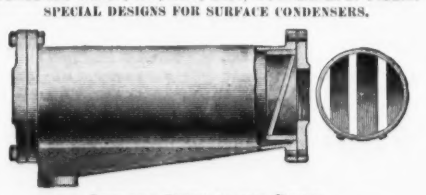

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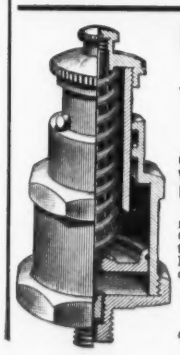

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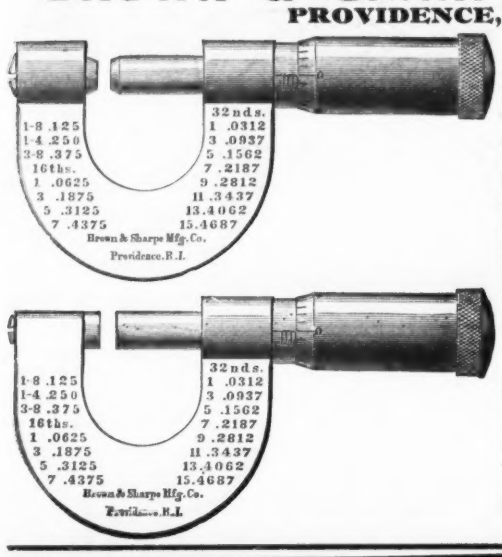

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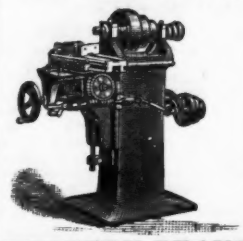

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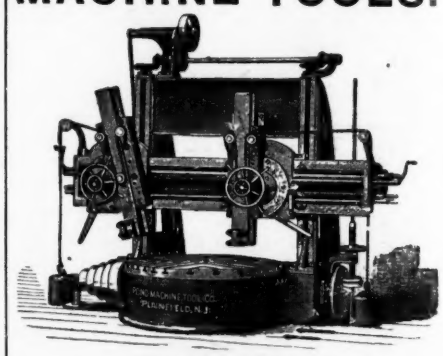

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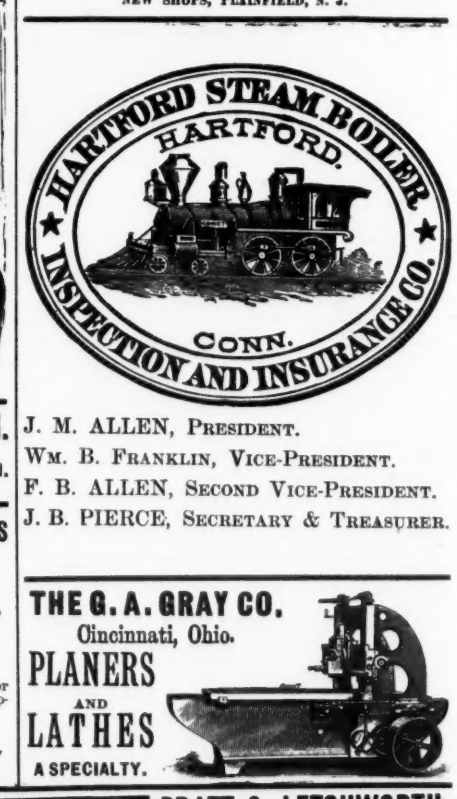

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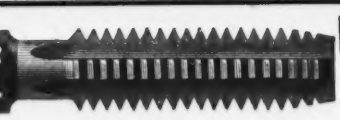

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